Alsamawi, A. *et al.* (2020-09-30), "Returns to intangible capital in global value chains: New evidence on trends and policy determinants", *OECD Trade Policy Papers*, No. 240, OECD Publishing, Paris.
<http://dx.doi.org/10.1787/4cd06f19-en>

OECD Trade Policy Papers No. 240

Returns to intangible capital in global value chains

**NEW EVIDENCE ON TRENDS AND POLICY
DETERMINANTS**

Ali Alsamawi,
Charles Cadestin,
Alexander Jaax,
Joaquim Guilhoto,
Sébastien Miroudot,
Carmen Zürcher

OECD TRADE POLICY PAPERS

This paper was approved by the Working Party of the Trade Committee in September 2020 and prepared for publication by the OECD Secretariat.

This paper, as well as any data and any map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Comments are welcome and can be sent to tad.contact@oecd.org.

Returns to Intangible Capital in Global Value Chains: New Evidence on Trends and Policy Determinants

Ali Alsamawi, Charles Cadestin, Alexander Jaax, Joaquim Jose Martins Guilhoto,
Sébastien Miroudot and Carmen Zürcher, OECD

Intangible capital, a broad category of knowledge-based assets that lack physical embodiment, increasingly shapes the distribution of income in global value chains (GVCs). While some intangible assets are reported in national accounts (e.g. R&D or computer software and databases), others are hard to detect in conventional statistics (e.g. brand value or organisational capital). In this paper, we combine information on factor income from national accounts with the OECD Inter-Country Input-Output tables in order to estimate returns to measured (i.e. included in national accounts) and 'unmeasured' intangible capital (captured as a residual) in GVCs. We find that total intangible capital accounts for about 27% of income in manufacturing GVCs and that this share has increased between 2005 and 2015 in OECD countries. The paper highlights differences across GVC stages and specific types of GVCs. A significant share of income is captured at the distribution stage, particularly in buyer-driven value chains. An econometric analysis suggests that trade and investment openness are important determinants of patterns in returns to intangible capital in GVCs. Direct public funding of R&D and the quality of intellectual property protection are associated with higher returns to intangible assets.

Keywords: Global value chains, intangible capital, factor income, trade policy, investment policy, intellectual property

JEL Codes: E01, E22, F23, F68

Acknowledgements

This report was prepared by Ali Alsamawi, Charles Cadestin, Alexander Jaax, Joaquim José Martins Guilhoto, Sébastien Miroudot and Carmen Zürcher of the OECD as part of a joint project by the Directorate for Financial and Enterprise Affairs (DAF), Directorate for Science, Technology and Innovation (STI) and Trade and Agriculture Directorate (TAD). The authors are grateful to Maria Borga, Koen de Backer, John Drummond, Tibor Hanappi, Ana Novik, Pierre-Alain Pionnier, Julio Raffo, Jehan Sauvage, Ari Van Assche, Colin Webb, Norihiko Yamano and Belen Zinni for useful comments and suggestions. This paper also benefitted from discussions in the OECD Working Party of the Trade Committee, which agreed to make it more widely available through declassification, as well as discussions in the Committee on Industry, Innovation and Entrepreneurship (CIIE) and Investment Committee. The authors thank Laëtitia Christophe and Michèle Patterson for preparing this paper for publication.

Table of contents

Executive summary	5
1. Introduction	7
2. The role of intangible capital in GVCs	8
3. Intangible capital in the world economy	13
4. Returns to intangible capital along the value chain	20
5. Policies explaining patterns in returns to intangible capital	29
6. Concluding remarks	37
References	39
Annex A. Methodology used to estimate returns to intangible capital and robustness checks	44
Annex B. Additional regression results	53

Tables

Table 5.1. Economic openness	33
Table 5.2. Innovation policies	35
Table 5.3. Returns to intangible capital and mark-ups	36
Table A A.1. Sources for the adjustment of labour shares	46
Table A A.2. Data sources for capital stocks	47
Table A A.3. Mapping of natural resources to TiVA industries	52
Table A B.1. Economic openness (including coefficients of controls)	54
Table A B.2. Innovation policies (including coefficients of controls)	55
Table A B.3. Economic openness (excluding sectors dependent on natural resource inputs)	55
Table A B.4. Innovation policies (excluding sectors dependent on natural resource inputs)	56
Table A B.5. Economic openness (controlling for linkages to natural resource sectors)	56
Table A B.6. Innovation policies (controlling for linkages to natural resource sectors)	57
Table A B.7. Economic openness (excluding countries highlighted in tax literature)	57
Table A B.8. Innovation policies (excluding countries highlighted in tax literature)	58
Table A B.9. Economic openness (using country-specific rate of return on tangible capital)	58
Table A B.10. Innovation policies (using country-specific rate of return on tangible capital)	59
Table A B.11. Economic openness (using industry-level rate of return on tangible capital)	59
Table A B.12. Innovation policies (using industry-level rate of return on tangible capital)	60
Table A B.13. Economic openness (using 9% as rate of return on SNA intangibles)	60
Table A B.14. Innovation policies (using 9% as rate of return on SNA intangibles)	61
Table A B.15. Returns to intangible capital and mark-ups	61
Table A B.16. Intellectual property right intensity	62

Figures

Figure 3.1. Factor income embodied in final demand, USD Billion, 2015	14
Figure 3.2. Final demand categories and factor incomes shares (%), 2015	15
Figure 3.3. Trade balances in terms of intangible income, by country, as a share of GDP	16
Figure 3.4. Flows of value added and returns to intangible capital embodied in world trade, by region of origin and destination, 2015	17
Figure 3.5. Shares of returns to intangible capital embodied in world consumption of final goods and services	18

Figure 3.6.	Shares of returns to intangible capital embodied in world production of final goods and services	19
Figure 4.1.	Factor income in manufacturing GVCs in OECD countries	20
Figure 4.2.	Distribution of income in manufacturing GVCs across stages of production	21
Figure 4.3.	Change in the share of income by production stage in OECD countries	22
Figure 4.4.	Factor income in service GVCs in OECD countries	23
Figure 4.5.	Factor income in manufacturing GVCs in non-OECD economies	24
Figure 4.6.	Growth in factor income in manufacturing GVCs of non-OECD economies	25
Figure 4.7.	Change in the share of returns to intangible capital by production stage in non-OECD economies	25
Figure 4.8.	Share of value-added by production stage and distribution of factor income across GVCs	26
Figure 4.9.	Change in the share of returns to intangible capital across GVCs	28
Figure A A.1.	Decomposition of gross domestic product	45
Figure A A.2.	Adjusted labour shares (2015)	46
Figure A A.3.	Estimation of returns to tangible capital using different rates of return	50

Executive summary

This report seeks to provide a better understanding of modern business models by examining the role of intangible assets in global value chains (GVCs). Findings identify policies that explain patterns of returns to intangible capital, focusing on the role of trade, investment, innovation and industrial policy.

The fragmentation of value chains across borders is one of the most prominent features of the process of economic integration in recent decades. The OECD Trade in Value-Added (TiVA) database shows how intermediate goods and services coming from different industries and countries are combined in order to produce goods or services that are sold to consumers all over the world. While TiVA reveals the central role of intermediate inputs in world trade and production, it does not provide insight into the way value is captured and shared among factors of production.

This report focuses on intangible capital, a broad category of knowledge-based assets that lack physical embodiment but fundamentally shape the value and income dispersion within GVCs. While some intellectual property products are reported in national accounts (R&D, mineral exploration and evaluation, computer software and databases and entertainment, literary or artistic originals), there are other intangible assets (such as superior brand value, sophisticated distribution strategies or organisational capital) that are hard to detect in conventional statistics but constitute an important source of value in GVCs.

By combining comprehensive information on factor income in the OECD Inter-Country Input-Output (ICIO) tables and TiVA database, returns to both measured and unmeasured intangible capital are calculated. Estimates show that intangible capital accounts for about 27% of income in manufacturing GVCs in OECD countries, with 6 percentage points corresponding to measured intangible assets and 21 percentage points to income derived from unmeasured intangible capital. The rest of value added is split between labour income (54%), returns to tangible capital (17%) and taxes minus subsidies on production (3%).

In OECD countries, returns to intangible capital have increased in the period studied (2005-2015) in manufacturing GVCs, while returns to intangible capital have been stable in services GVCs. In non-OECD economies, wages are catching up and there is an increase in the share of income going to labour with a smaller share of income accruing to intangible capital. However, in absolute terms, returns to intangible capital have also increased.

A closer analysis of specific types of GVCs reveals important differences in the way factors of production are remunerated based on the industry and the way the GVC is organised. A significant share of income is captured in the distribution stage, particularly in buyer-driven value chains (e.g. textiles and apparel) where returns to intangible capital have increased at the end of the value chain. But in some producer-driven value chains (e.g. motor vehicles), there is an increase in returns to intangible capital at the final stage of production and not in the distribution stage.

Key findings

While the policy implications of GVCs have been analysed by looking at the domestic value added generated by international trade and investment, it is also important for policy makers to understand how this value added goes to different factors of production. This report investigates how returns to intangible capital are impacted by policies with the following findings.

Trade and investment openness

- Trade and investment openness are important determinants of patterns in returns to intangibles in GVCs. Lower tariffs and lower barriers to foreign direct investment are positively associated with returns to intangibles as recorded in national accounts. Policies restricting trade and investment limit firms' ability to benefit from foreign knowledge. The dismantling of trade barriers can generate opportunities to learn via importing.
- Open services markets are crucial. The link between openness and returns to intangibles is clearly visible in the case of restrictions to services trade. Specialised foreign services inputs enhance firms' capabilities to develop and improve business strategies based on intangible capital

Innovation and industry policies

- Direct public funding of R&D activities increase returns to intangibles. Public support for business R&D boosts returns to intangible capital. While R&D tax incentives primarily increase returns to intangibles assets recorded in national accounts, the direct public funding of R&D conducted by business is associated with higher returns to measured intangible capital and returns to intangible capital not recorded in the national accounts.
- The quality of intellectual property protection helps to explain the distribution of returns to intangibles in GVCs. IPR policies are efficient tools enabling firms to derive higher income from their intangible assets recorded in the national accounts.

1. Introduction

The concept of global value chains (GVCs) was first introduced in the academic community with case studies describing all activities needed to produce a good or a service from its conception to its end use (Gereffi, 2019^[1]). The release of the OECD Trade in Value-Added (TiVA) database and its underlying Inter-Country Input-Output (ICIO) tables (and similar initiatives such as the World Input-Output Database) facilitated examination of GVCs at the aggregate level across countries. Since the publication of *Interconnected Economies* (OECD, 2013^[2]), many policy reports have used such data to look at where income is generated in GVCs.

One of the main contributions from TiVA was to unveil the role of intermediate inputs in world trade and production, i.e. the way firms combine intermediate goods and services coming from other industries – and in some cases other countries – in order to produce goods or services that are then sold to consumers all over the world. The reason why it is important to account for intermediates was illustrated with the iPhone example (Xing and Detert, 2010^[3]). Designed in California but manufactured in China, the smartphone includes a small share of Chinese value added corresponding to assembly costs, while the bulk of the value is coming from expensive parts and components manufactured in third countries (processor, screen, memory, etc.). The iPhone tells a different trade story in gross and value-added terms, as captured in TiVA.

However, TiVA statistics are not telling the full story. In particular, they do not indicate how Apple – a US-based company – benefits from sales of iPhones that are recorded in Chinese exports. The seminal paper by Dedrick et al. (2010^[4]) that started the series of GVC case studies focusing on Apple products (first looking at iPods) was precisely investigating this question, asking “who profits from innovation in GVCs”. The contribution of Apple to the value chain is through intangible assets (design, branding, and technology) that ultimately generate income for the company. However, the value is captured at the end of the value chain, at the distribution stage, through a wholesale trade margin and additionally a retail trade margin when Apple acts as the retailer.

As a first step towards a better understanding of such business models and a more accurate assessment of who benefits from global production, this report looks at the role of intangible assets in GVCs by providing a decomposition of value-added identifying returns to labour, tangible and intangible capital (measured and unmeasured). These new data are used to discuss the role of industry, innovation, investment and trade policies in the way countries capture value in GVCs. While previous policy discussions were about how countries ‘participate’ in value chains, i.e. how they join them and increase their share of domestic value added, this report provides additional insights on how value is captured and shared among factors of production, with a special emphasis on intangible capital.

There are several challenges in building comprehensive data across countries on labour compensation and returns to capital. In order to look at factor income across GVCs, estimates have to be created for all countries, including when no information can be directly found in official statistics. It should be kept in mind that the data used in this report can only provide the broad picture rather than accurate results at the country and industry level. This is why some econometric analysis is carried out to isolate the ‘noise’ and to identify some more robust relationships between policies and returns to intangible capital.

The report is organised as follows. Section 2 explains the role of intangible assets in GVCs and provides a brief non-technical description of the methodology used to estimate returns to labour, tangible and intangible capital. Section 3 gives an overview of the role of intangible capital in the world economy, while Section 4 offers additional insights with a GVC approach looking at intangible capital in different stages of production. Finally, Section 5 relies on econometric techniques to look at the impact of various policies on returns to intangible assets.

2. The role of intangible capital in GVCs

2.1. What is intangible capital?

When firms produce, they combine two types of primary factors of production, capital and labour. Labour is remunerated through wages. Capital corresponds to the accumulation of fixed assets over years and is also remunerated or paid for. Fixed assets have a long “service life”, over one year, and depreciate along this life. They are owned by the firm and valued in the firm's balance sheet, which is used to produce capital accounts at the country level. Every year, the value of fixed assets decreases due to their use or the fact that new assets would provide better capital services. This depreciation is taken into account and fixed assets are valued at the price they would be sold on the date they are valued.

Traditional capital includes physical and financial assets, such as machinery, equipment or buildings. Intangible capital refers to assets that have no physical or financial embodiment. There is a broad range of intangible assets. The System of National Accounts 2008 (SNA 2008) defines as assets four categories of ‘intellectual property products’: ‘research and development’, ‘mineral exploration and evaluation’, ‘computer software and databases’ and ‘entertainment, literary or artistic originals’.

However, these categories do not fully cover the range of intangible assets through which firms create value. For example, they do not include brands, human or organisational capital. The reason is that it would be challenging for national accountants to put values on such assets and incorporate them in growth accounting. The literature (and previous OECD work) has however shed light on the importance of such intangible assets and provided alternative measurements (Le Mouel and Squicciarini, 2015^[5]). Following the work of Corrado et al. (2005^[6]), there are three different classes of intangible assets: (i) computerised information, (ii) innovative property, and (iii) economic competencies. The first class includes computer software and databases. The second class encompasses all the activities linked to innovation such as R&D, mineral exploration, copyrights and licenses. Lastly, the third class includes brand equity (with related expenditure on advertising and market research), firm-specific human capital and organisational structure.

Haskel and Westlake (2018^[7]) indicate that intangible capital has four characteristics, labelled the four S's, with important implications. First, since there is no resale market as it is the case for tangible capital, investment in intangible capital is a *sunk* cost, thus making its financing more challenging. Second, intangible capital creates more *spillovers* than tangible capital because it can be used by others. It implies that a slowdown in intangible investment affects other firms and not just the ones with intangible assets. Third, intangible assets are *scalable* as their marginal product declines slowly, explaining why intangible-intensive firms can become very big and create a productivity gap with others. Fourth, there are investment *synergies* with other intangible investment and with human capital. Such complementarities can explain why firms owning intangible capital may pay higher wages. Because intangible capital has different properties than tangible capital, it is important to be able to account for it in the analysis of GVCs.

2.2. How is intangible capital accumulated?

There are numerous challenges in the measurement of intangible capital. Unlike physical or financial assets that are bought on markets, a large share of intangible capital is built within firms through internal R&D. The third class of intangible capital in the classification of Corrado et al. (2005^[6]) is especially difficult to measure as human capital and organisational knowledge are specific to the firm.

As a consequence, national accountants have a cautious approach and only account for intangible capital that has some market value or can be clearly identified as an asset with some value derived from its costs. Hence the approach of the SNA 2008 with a limited set of intangible assets recorded that are easier to identify. The approach followed in this report is to take into account these intangible assets for which there is information but also to account for the unmeasured intangible capital.

In the past, the accumulation of capital was mostly based on physical capital. It has changed with the ICT revolution in the 1990s and more recently the digital transformation. As shown by Hulten (2010^[8]), tangible assets account for only 4% of Microsoft assets and 1% of its market value (data from 2006). In 2018, the market capitalisation of Apple crossed the one trillion dollar mark for the first time. For the same fiscal year, Apple reported USD 266 billion in revenues and USD 366 billion in total assets, of which tangible fixed assets were only USD 41 billion. As with Microsoft, this leaves a considerable gap of income unaccounted for in growth accounting, which illustrates ‘capitalism without capital’ (Haskel and Westlake, 2018^[7]).

Companies like Booking.com, AirBnB or Uber have become major players in their industry almost without tangible capital. Booking.com does not own any hotels, AirBnB has no real estate and Uber has no fleet of vehicles. Their main assets are brands, platforms and networks. Before internet platforms, other companies used licensing and franchising to expand without tangible capital by licensing their brands, processes and knowledge. This is how most fast food and coffee chains have accessed markets across the globe. Overall, intangible assets have become a prominent feature of the modern business world and are accumulated at a faster pace than tangible assets due to their scalability.

2.3. What is the role of intangible capital in GVCs?

When talking about GVCs, the emphasis is generally on intermediate inputs. The different production stages describe how raw materials are transformed and processed and how inputs produced in different countries are assembled in one location before being exported to consumers all over the world. But one of the main reasons why companies organise their production in GVCs is to locate their intangible assets in specific places where skills, knowledge or a favourable tax environment are available. These assets can then be used by all (affiliated) firms in the value chain. Unlike machines or equipment that can only benefit one location and are costly to move, intangible assets can be used anywhere at almost no extra cost.

However, it is in the interest of firms to keep the benefits of intangible capital within their boundaries. By their nature, some of these assets can also be reproduced. This is why intangible assets are often related to multinational enterprises (MNEs) and kept within their network of affiliates. Intangible assets can nonetheless be shared between independent companies through contractual relationships. This is the case with licensing and franchising, where companies receive royalties for the use of their intangible assets while remaining their owners.

Intangible assets play a more important role at the beginning and at the end of the value chain. They are closely related to the ‘smile curve’ described in the GVC literature (Mudambi, 2007^[9]; Baldwin, Ito and Sato, 2014^[10]). Originally developed to describe the position of one individual company (Acer), the smile curve illustrates how value might be distributed along GVCs. At the beginning of the value chain, activities like R&D and design allow companies to create innovative and hard-to-imitate products and services, hence enabling them to reap higher margins and returns. Similarly important in terms of value capture is the opposite end of the value chain where activities such as marketing, branding, distribution and customer services take place. Brands are key intangible assets that explain the success of firms. At the same time, interactions with customers allow companies to develop knowledge, collect data and customise products as a further intangible source of value.

The creation and development of intangible assets largely underpin these activities. Therefore, they fundamentally shape the value and income dispersion within GVCs. Depending on the size and type of intangible assets, the income derived within GVCs will be different across countries (as some countries are more ‘specialised’ in the production of intangible assets), industries (as not all industries are as intensive in intangible assets, hence do not show a similar smile curve) and firms (with some firms, e.g. MNEs, known to invest more in intangible assets).

Incorporating the distribution stage into the analysis is important for companies like Apple and other so-called ‘factory-less producers’ that create value in the wholesale and retail stage (Bernard and Fort, 2015^[11]). In most GVC studies, the last stage is not covered because international input-output tables are in basic prices and do not include the margin of the distributor at the end of the value chain. In this report, the trade margins that are otherwise accounted for in the wholesale and retail industry are brought back to the industry producing the products in order to have the full picture in terms of allocation of income along the value chain.

2.4. How can returns to intangible capital be measured?

Overall approach

There are a variety of challenges in measuring the contribution of intangible capital to value added. This report builds on a methodology recently developed by Chen, Los and Timmer (2018^[12]). This methodology regards as returns to intangible capital any value added not explained by labour or tangible capital, with an ex-ante estimation of returns to tangible capital. The difference in this report is that an ex-ante estimation of returns to intangible assets recorded in national accounts is also removed from value added. The resulting residual is therefore pointing at returns from other intangible assets not included in the SNA 2008, such as the contribution of brands or organisational capital. Value added is thus decomposed into four categories of factor income: the remuneration of labour, returns to tangible capital, returns to intangible capital recorded in national accounts (measured intangible capital) and a residual corresponding to returns to other types of intangible assets (unmeasured intangible capital).

Since national accounts do not pick up the full contribution of intangible capital, there would be an under-estimation of its role by relying only on intangible assets reported. By adding a residual, the analysis in this report accounts for the unmeasured intangible capital. However, it is important to note that this residual may include returns that are maybe not fully related to intangible capital. In particular, value added also reflects risk and rents related to market power, something that would be captured as other intangible capital with the residual approach. Some risk and market power can be derived from intangible assets but can also be explained by other determinants of value added (for example government regulations).

Data

The data used for the analysis of GVCs are the OECD Inter-Country Input-Output (ICIO) tables that are the underlying data of the OECD Trade in Value-Added (TiVA) database. This dataset covers 64 economies and 36 industries over the period 2005-2015. For each country and industry, ICIO tables indicate gross output, final demand, intermediate consumption and value added. Using input-output techniques, such tables can provide a full decomposition of final demand for a given country and industry detailing the value-added contribution of all countries and industries. This is how GVCs are often empirically analysed, distinguishing the value added by the final producer from the contribution of all suppliers upstream in the value chain.

To capture the full value chain, the trade margins that are estimated to convert purchasers’ prices into basic prices are added to the output in each GVC (which is in basic prices). These trade margins

correspond to value added in the distribution stage. They are reallocated to the wholesale and retail industry when constructing the ICIO. For the analysis in this report, they are brought back to the relevant GVC, i.e. to the industry producing the final products that are sold by wholesalers and retailers.

National accounts already include information on gross value added, taxes minus subsidies on production, labour compensation and gross operating surplus and this information is harmonised across countries in the ICIO framework. Taxes minus subsidies on production are part of value added and are reported in the decomposition in addition to the four categories of factor income. Gross operating surplus is generally together with “mixed income”, which is production by unincorporated enterprises owned by households. The mixed income is reallocated to labour and capital through different methodologies depending on the availability of data (Annex A).

Calculation of returns to tangible and intangible capital

The calculation of returns to tangible and intangible capital requires information on their stocks, rates of returns and depreciation rates. The source is national accounts but also complementary datasets such as the OECD STAN database or the EU KLEMS and WORLD KLEMS projects. As the dataset covers a broader set of countries as compared to Chen et al. (2017^[13]), different rates of returns are used for tangible capital across three groups of countries (Annex A). But a fixed return to intangible capital measured in national accounts is assumed.

Returns to unmeasured intangible capital are calculated as the difference between gross value added and the sum of taxes minus subsidies on production, labour compensation, returns to tangible capital and returns to measured intangible capital.

One advantage in calculating returns to unmeasured intangible capital as a residual is that there is no need to precisely identify the intangible assets involved. Estimates capture the contribution of assets that are not reported in national accounts, such as brands or organisational capital. However, with a residual approach, these assets cannot be identified.

Another issue, not specific to the methodology, is that the gross operating surplus in national accounts is affected by transfer pricing and by profit shifting strategies of firms. To mitigate the impact of taxes, firms might reduce their profit in some places and increase it in others. The value added reported in national accounts can be distorted by fiscal optimisation strategies. However, when decomposing value added along the value chain based on final products, transfer pricing affecting the price of intermediate inputs has no impact on the overall allocation of factor income. But profit shifting affects the allocation of value added across production stages.

Calculation of factor income along the value chain

When decomposing value added for each country and industry in the ICIO, what is obtained is the allocation of factor income for any output. It provides the decomposition of value added in the final stage of production. The value chain perspective is obtained by input-output techniques similar to the ones used to calculate value added in final demand in the TiVA database. For each industry of final production in any country, value added is traced back to all the countries and industries that have participated in the value chain and decomposed into factor income. The income of each factor is added across countries and industries to obtain the allocation of value added in upstream stages of production. Finally, for the distribution stage, the trade margins are decomposed into factor income using the value-added decomposition of the wholesale and retail industry for the same country as final production. One assumption is that factor income for the distribution of products sold abroad is similar to the domestic distribution. It might not be the case but there is no information available to break down margins across consuming markets.

2.5. What are the main policy issues?

There is a broad range of policy issues related to intangible capital in GVCs. This report focuses on policy implications for trade, investment, innovation and industrial policy. There are also important challenges related to other policy areas, such as competition or tax policy.

Trade

With respect to trade, the report draws the attention of policymakers on the importance of capital goods and services in the formation of capital. While capital is measured in monetary units and has to be financed, capital in firms takes the form of machines, equipment and knowledge. These assets are accumulated partly through trade. Trade in capital goods and services accounted for 12% of global trade in 2016 (according to the TiVA database). It is often through this type of trade that companies have access to key knowledge and technologies from abroad. Rising protectionism can have a detrimental impact on capital formation and ultimately on growth.

Investment

Since a significant share of income in GVCs comes from intangible assets, the main policy question for investment is whether existing regimes and rules facilitate or encourage such investment. Part of this investment is covered by rules for services (with an overlap with trade policy) and investment in services is generally more restricted than for goods. Investment in intangible capital is also through intellectual property (patents, trademarks, copyrights, etc.) and differences across regimes could explain how firms set up their activities in GVCs.

One important observation is that from the perspective of firms, trade, investment and the use of intellectual property are alternative forms of market access. While policymakers may look at these policies in isolation, their interaction is what could explain firm strategies. This calls for a closer look at the co-ordination between trade, investment and innovation policies, in particular as part of a GVC strategy.

Industrial policy

The new interest for industrial policy is precisely about creating an enabling environment through innovation, trade and competition policy that would allow firms to emerge and grow in new activities (particularly related to the digital economy), not under the protection of the State but with all the needed economic incentives to ensure efficiency. Specific types of support (such as tax breaks for R&D) or government programmes for the development of key technologies are part of the tools that are discussed and are all related to intangible capital. The question is whether through pro-active policies or through the creation of the right regulatory environment, governments can foster investment in intangibles. The GVC angle is interesting to answer this question as when it comes to active policies and support, there is the risk of a race to the bottom or simply un-coordinated actions that reduce economic efficiency and prevent countries from benefiting from GVCs.

Innovation

Assessing whether policies facilitate or hinder the accumulation of intangible assets is important when acknowledging its role in innovation and growth. OECD analysis highlights that since the 2000s, intangible assets explain a significant share of productivity growth (OECD, 2013^[14]). At the same time, the accumulation of intangible capital is also regarded as one factor explaining an increase in market concentration and higher productivity gaps between frontier firms and laggards (Andrews, Criscuolo and Gal, 2016^[15]). While not directly analysed in this report, there are also implications for competition policy.

The issue of competition is important as market power can be derived from the use of intangible capital, particularly in digital-intensive sectors.

Other policy areas

Finally, as income related to intangible capital in GVCs grows, the question arises as to the impact of tax regimes and international tax rules. Through intangible assets, firms can more easily move income across countries and shift profit. This report does not focus on these issues but tax policy is an important determinant of firm strategies and the organisation of GVCs.

2.6. Relation to other work

Many OECD reports have covered issues related to intangible assets, looking at the value they create (OECD, 2006^[16]) and how they support growth and innovation (OECD, 2013^[14]). Important work has also been undertaken on the measurement of individual categories of knowledge-based assets, such as organisational capital (OECD, 2015^[17]).

The contribution of this report is twofold. First, new data have been developed in the context of the TiVA project to estimate stocks of tangible and intangible capital. Second, we focus on GVCs and calculate returns to intangible capital in the different production stages, while former analysis was at the industry level or firm level.

As compared to Chen et al. (2017^[13]; 2018^[12]) and the *World Intellectual Property Report 2017* (WIPO, 2017^[18]), which are also looking at returns to intangible capital in GVCs, we cover a more recent period of time (where recent years are not projected but based on official national accounts) and a broader set of countries (with all countries included in the TiVA database). Moreover, we account for intangible capital already measured in national accounts since the implementation of the SNA 2008, thus giving some insights on the relative share of measured and unmeasured intangible capital in the different GVCs.

3. Intangible capital in the world economy

Final goods and services produced in the world have two broad destinations, consumption or investment. If they become an investment (fixed capital), they can be used as a way to produce more goods and services in the future. The production of the final products remunerates the factors of production, labour and capital (tangible and intangible), and generates income to the government through the taxes paid. Applying input-output analysis to the ICIO tables estimated by OECD, it is possible to trace how the value-added components (the income of factors of production) end up into final goods and services.

To better understand the role played by intangible capital in the world economy, this section investigates: (i) how the returns to intangible capital are associated with the production of final goods and services for consumption and investment; (ii) which role the returns to intangibles play in the domestic economy and in international markets; and (iii) how countries in the world are related to returns to intangibles, from the production, consumption and investment side.

Especially regarding the description of differences across countries presented in this section, it is important to bear in mind the multi-faceted difficulties in measuring returns to intangible capital. While these comparisons rely on a carefully assembled dataset and draw on a methodology inspired by the recent literature (Chen et al., 2017^[13]; Chen, Los and Timmer, 2018^[12]), the picture emerging from this analysis may have to be revised once more precise data become available.

3.1. Factor income

Following the definition of national accounts, the demand for final goods and services can be broken down into six categories: a) households consumption; b) government consumption; c) capital formation; d) non-profit institutions serving households; e) non-residents expenditure; and f) changes in inventories. From the numbers presented in Figure 3.1, in the world, in 2015, households were responsible for the consumption of 54.1% of final goods and services, 16.9% were consumed by the government, while 25.5% were capital formation, and the remaining 3.5% were spread out among the other components of final demand (non-profit institutions, non-resident expenditure and changes in inventories). Of these goods and services, 19.4% were from foreign origin while the remaining 80.6% were from domestic origin. A breakdown of these shares among the value-added components incorporated into foreign and domestic products shows that: i) from foreign sources, labour incorporated is on average 46.2%, while returns to tangible and capital are 18.7%, returns to intangible capital are 25.7% (5.6% for measured intangibles and 20.1% for unmeasured intangibles) and taxes¹ 9.3%; and ii) from domestic origin, the shares are 51.3% for labour, 21.6% for returns to tangible capital, 19.6% for returns to intangible capital (3.3% for measured intangibles and 16.3% for unmeasured intangibles), and 7.5% for taxes. These results show that relative to the products from domestic origin, the goods and services traded in the world are less intensive in labour and more intensive in capital, specifically in intangible capital, which more than compensate the smaller share of returns to tangible capital.

Figure 3.1. Factor income embodied in final demand, USD Billion, 2015

Source: Authors' calculations based on the OECD ICIO and national accounts.

¹ Taxes refers to the net taxes (taxes less subsidies) which are paid on the inputted goods and services used in the production and on production.

From Figure 3.2, which shows how the value-added components are incorporated in the final demand elements and how the final demand explains the generation of value added, we can see that 47.4% of the returns to measured intangible capital are incorporated in the final goods and services purchased by households, 32.7% goes to capital formation, 16.3% to government, and 3.6% to the other final demand categories. We can also see that the consumption of households accounts for 60.1% of the returns to unmeasured intangible capital incorporated in total final demand, substantially more than the share explained by government consumption (10.5%) and capital formation (26%). On the right chart, the decomposition of consumption by the final demand elements highlights that returns to intangible capital (measured plus unmeasured) have a share of 22.2% of the value consumed by households, 14.2% of the value consumed by the government, 22.2% of the value in capital formation and 20.3% of the value in the other elements of the final demand. Therefore, returns to intangible capital can be seen as closely related to households' consumption and investment.

Figure 3.2. Final demand categories and factor incomes shares (%), 2015

Source: Authors' calculations based on the OECD ICIO and national accounts.

3.2. “Exporters” and “importers” of intangible income

In Figure 3.1, returns to intangible capital of foreign origin correspond to income embodied in traded goods and services. When countries export, they generate income through the remuneration of factors of production at home involved in the production of exported products. Similarly, imports generate income in foreign countries where the corresponding goods and services are produced. At the country level, one can therefore calculate a trade balance in terms of intangible income (i.e. income coming from measured and unmeasured intangible capital), which is the difference between ‘exports’ of intangible capital income (returns to intangible capital embodied in exports) and ‘imports’ (returns to intangible capital embodied in imports).²

Figure 3.3 illustrates the 2015 intangible trade balance (as a share of GDP) of OECD and G20 countries. The Figure identifies the main net exporters and importers of intangible income in the world. It distinguishes manufacturing (excluding the coke and refined petroleum industry) from services (focusing on business services), as countries are specialised in different types of activities where intangible assets play a different role.

² There are also returns to intangible capital derived from activities of foreign affiliates that are not included in this analysis.

Figure 3.3. Trade balances in terms of intangible income, by country, as a share of GDP

Manufacturing and services, OECD and G20 countries, 2015

Note: Services include only business services (construction, distribution, transport, hotels and restaurants, audiovisual, telecommunications, IT and information, financial activities and other business services). Real estate is excluded.

Source: Authors' calculations based on the OECD ICIO and national accounts.

The main net exporters of intangible income (measured and unmeasured), according to these results, can be divided into two major groups:

- More developed countries with the R&D necessary to develop tradable goods based on high technology, with a trade surplus in manufacturing (Panel A). This group includes economies like Ireland, Korea, Switzerland, Lithuania, Germany and Japan. In the case of Japan, despite being a net importer of value added (when considering other factors of production not shown on Figure 3.3), it is a net exporter of returns to intangible capital.
- Countries specialised in exports of business services with a high intangible income content, such as Luxembourg or Poland, but also Ireland, Lithuania and Switzerland who were already part of the first group (Panel B). Net exporters of intangible income through services also include emerging economies that are catching up and have developed a comparative advantage in services, such as India.

Figure 3.4 shows the flows of value-added and returns to intangible capital embodied in world trade aggregated into five regions: East and South East Asia, Europe, North America, South and Central America, and 'other regions'. The flows of value-added and returns to intangible capital suggest a higher integration of production inside Europe (50.8% of the value-added and 51.1% of the returns to intangibles remain in the region) and in East and South East Asia (32.8% of the value-added and 38.3% of the returns to intangibles remain in the region). Countries in the other regions are less integrated among themselves and depend more on trade with the two first regions. Europe has a bigger share of the world value-added embodied in exports (36.1%) than of the world returns to intangibles embodied in exports (28.1%).

Figure 3.4. Flows of value added and returns to intangible capital embodied in world trade, by region of origin and destination, 2015

Note: Domestic flows of countries are excluded.

Source: Authors' calculations based on the OECD ICIO and national accounts.

Figure 3.5 looks at the countries' shares of returns to intangible capital embodied in the world consumption of final goods and services. From domestic and foreign sources, excluding the 'rest of the world' region, 15 countries (Brazil, Canada, China, France, Germany, India, Indonesia, Japan, Korea, Mexico, Russia, Saudi Arabia, Spain, Turkey, United Kingdom and the United States) account for around two thirds of the returns to intangible capital embodied in world consumption of final goods and services (Panel A). The

United States alone is responsible for the consumption of 20.6% of the returns to intangibles, of which 80.2% are from domestic origin and 19.8% are imported (i.e. capital returns are embodied in imported products). It is also interesting to observe the increase in the share of China from 4.9% in 2005 to 9.6% in 2015, and the decrease in the share of Japan, from 15.7% in 2005 to 9.3% in 2015.

Figure 3.5. Shares of returns to intangible capital embodied in world consumption of final goods and services

By country, from domestic and foreign sources, 2005 and 2015

Source: Authors' calculations based on the OECD ICIO and national accounts.

On the production side, Figure 3.6 shows the shares of countries in returns to intangible capital embodied in the production of final goods and services. Overall, the main producers are also the main consumers, as analysed above. However, the shares of returns to intangible capital on the production side are more evenly distributed among countries than on the consumption side. The United States account for 18.9% of returns to intangibles (adding the measured and unmeasured capital shares), followed by Japan (9.8%) and China (8.2%).

Figure 3.6. Shares of returns to intangible capital embodied in world production of final goods and services

By country, 2005 and 2015

Source: Authors' calculations based on the OECD ICIO and national accounts.

4. Returns to intangible capital along the value chain

In this section, we look at the same data as in the previous Section but with a GVC perspective, as in Chen et al. (2017^[13]), distinguishing the different production stages and accounting for value along the whole value chain from raw inputs to distribution. What we call a 'GVC' is the income generated by the production of final goods (or services) by a given industry together with the trade margins associated to their sales.

4.1. Returns to intangible capital in OECD countries

Looking first at OECD countries and the income generated by all manufacturing GVCs, about 54% of value added is going to the remuneration of labour in 2015 (Figure 4.1). Adding the measured and unmeasured intangible capital, returns to intangible capital account for 27% of value added and are higher than returns to tangible capital (17%). Both returns to intangible assets captured in national accounts (measured intangible capital) and returns that we have estimated as a residual (unmeasured intangible capital) increased between 2005 and 2015. This is a slight increase when aggregating all manufacturing GVCs but the increase is more pronounced when looking at specific industries (see below). Taxes minus subsidies remained stable over the period (3% of value added).

A decline in the labour share and shift to capital has been observed in most OECD countries since the 1980s (Karabarbounis and Neiman, 2014^[19]). It coincided with the rise of GVCs, which are also seen as having reinforced “winner-takes-most” dynamics where innovative firms at the technological frontier with low labour shares capture higher shares of income (Schwellnus et al., 2018^[20]).

Figure 4.1. Factor income in manufacturing GVCs in OECD countries

Share in percentage of gross value added along the value chain (final demand plus trade margins), 2005-2015

Source: Authors' calculations based on the OECD ICIO and national accounts.

It is also interesting to look at how income is distributed along the manufacturing value chain (Figure 4.2). On average, most of the value is added during the production of inputs (about 50%). Then, final production accounts for 26% of value added and distribution 24%. This distribution stage is generally overlooked in TiVA analysis as its income is allocated to the wholesale and retail trade industry in the service sector. In our analysis, we allocate the distribution income to the corresponding manufacturing GVCs, so that the income of Apple when selling iPhones, for example, is in the ICT & electronics value chain. A significant share of value added (about one-quarter) is generated during the distribution of manufacturing goods and factory-less producers such as Apple capture the income derived from their intangible assets during this stage.

Figure 4.2. Distribution of income in manufacturing GVCs across stages of production

Share in percentage of gross value added along the value chain, OECD countries, 2005-2015

Source: Authors' calculations based on the OECD ICIO and national accounts.

Final production can be a low value-added stage when it consists of the assembly of processed inputs in which are embodied the main returns to tangible and intangible capital. But in some GVCs, final production can be the stage where high returns are derived from the technology required for the production of the goods. For example, in the case of pharmaceuticals, the final medicine is the complex good that requires the use of intangible assets, as opposed to intermediate inputs that are generally more basic chemicals. There is some heterogeneity across GVCs in the share of income generated by each production stage (see next sub-section).

Intangible assets that matter during the production of intermediate inputs can be classified into two categories. On the one hand, there are intangible assets in the services activities upstream that are outsourced by manufacturing firms. For the design, engineering, testing and marketing of their products or for the logistics needed in their operations, final producers rely on various services that are often knowledge-intensive and create high returns to intangibles upstream. On the other hand, manufacturers of parts and components and more upstream producers of raw materials also have their own investment in intangible assets. Depending on the type of GVC, the technology can be more upstream, such as micro-processors, memory chips and LCD screens in the manufacturing of ICT and electronics products (e.g. mobile phones). Companies specialised in the production of these high value inputs have higher investment and returns to intangible capital for example. Because there is an important fragmentation of production and specialisation along the value chain, half of factor income is generated during the production of intermediate inputs in manufacturing GVCs.

Looking at the change in factor income by production stage, it seems that income to labour and tangible capital is shifted upstream in the value chain towards inputs, while income to intangible capital moves towards the final stage and distribution (Figure 4.3). This is consistent with the idea of lead firms focusing more on high value-added activities and leaving the more labour-intensive and tangible-intensive activities to suppliers.

Figure 4.3. Change in the share of income by production stage in OECD countries

Manufacturing GVCs, percentage points, difference between the share of gross value added in 2015 and 2005

Note: The total change (in percentage points) is the sum of the change observed in the three stages (inputs, final production, distribution).

Source: Authors' calculations based on the OECD ICIO and national accounts.

There is an overall decline in the labour share in manufacturing GVCs in OECD countries but it is more pronounced in the final stage of production. For the production of intermediate inputs, Figure 4.3 suggests that there was a substitution between tangible capital and labour, possibly related to advanced robotics and more automation. At the final stage, the substitution is rather between labour and intangible capital. Both the measured and unmeasured intangible capital have higher returns. For the former, it suggests important investment in R&D, as well as software and databases, creating higher returns for final manufacturers. The significant increase in returns to unmeasured intangible capital indicates that organisational capital, market research or branding can also have contributed to this shift towards

intangible income. The evidence is consistent with the idea that the digital transformation has impacted the organisation of value chains and particularly the final production stage.

While returns to intangible capital have increased at a slower pace in the distribution stage, the data also suggest that new business models are found in this part of the value chain. With e-commerce and the consolidation or concentration observed in physical wholesale and retail, distribution becomes less labour-intensive and intangible capital plays an increasing role to optimise logistics, create scale economies and to link producers and consumers. The increasing share of returns both for measured and unmeasured intangible capital suggests that, as this industry relies more on data and R&D, there is also more income coming from branding and marketing.

When looking at GVCs for business services (i.e. construction, distribution³, transport, hotels and restaurants, audiovisual, telecommunications, IT and information services, financial activities and other business services), we do not observe significant changes over time in factor income for the period covered (Figure 4.4). In the case of services, there is no decrease in the labour share as services are often about investing in people and human capital leads to higher wages and not just higher returns for intangible capital.⁴ If there is a decrease in the share of income going to unmeasured intangible capital (possibly due to more competition over time in services activities), we observe a slight increase in measured intangible capital, suggesting that there is also investment in R&D and software and databases in service GVCs. This category also covers 'entertainment, literary or artistic originals', which are intellectual property assets playing an important role in the publishing, audiovisual and broadcasting activities.

Figure 4.4. Factor income in service GVCs in OECD countries

Share in percentage of gross value added along the value chain (final demand plus trade margins), 2005-2015

Note: Service GVCs include only business services (construction, distribution, transport, hotels and restaurants, audiovisual, telecommunications, IT and information, financial activities and other business services). Real estate is excluded.

Source: Authors' calculations based on the OECD ICIO and national accounts.

³ Distribution is included both as part of the trade margins for manufacturing goods and as a stand-alone service activity in our analysis.

⁴ There is however some heterogeneity across service GVCs and some of them have a declining labour share (see disaggregated results in Section 4.3).

4.2. Returns to intangible capital in non-OECD economies

The above analysis was based on GVCs of OECD countries only (i.e. with an OECD economy as country of final production). When looking at manufacturing GVCs in non-OECD economies, the distribution of factor income is different (Figure 4.5). First, a smaller share of value added is going to labour (49% in 2015). But unlike the trend observed for OECD countries, this share increased over time (it was 46% in 2005). Wages are catching up, particularly in emerging economies. The share of returns to tangible capital also increased, reaching a level similar to OECD countries at the end of the period. Developing and emerging economies are also characterised by a high level of investment in infrastructure, machine and equipment. Buildings also account for an increasing share of tangible capital with the rise in real estate prices.

As a consequence, returns to intangible capital decreased in non-OECD economies. But it should be emphasised that these returns are measured as a share of a growing value added. The absolute level of returns to intangible capital also had a significant growth rate but labour compensation increased at a faster pace (Figure 4.6). It is only the unmeasured intangible capital that had a lower growth rate in returns.

The increased investment in intangible capital in non-OECD economies can be seen in the higher returns for measured intangible assets. On Figure 4.5, we observe the same share (6% in 2015) and the same increase as in OECD countries (1 percentage point added between 2005 and 2015). In emerging economies too, R&D and software and databases increasingly contribute to value added and there is no sign that these economies are falling behind the trend in terms of intangible capital accumulation.

Figure 4.5. Factor income in manufacturing GVCs in non-OECD economies

Share in percentage of gross value added along the value chain (final demand plus trade margins), 2005-2015

Source: Authors' calculations based on the OECD ICIO and national accounts.

Figure 4.6. Growth in factor income in manufacturing GVCs of non-OECD economies

Growth of factor income in current USD, 2005=100, 2005-2015

Note: Taxes minus subsidies on production not shown.

Source: Authors' calculations based on the OECD ICIO and national accounts.

The diminishing share of returns to the unmeasured intangible capital can also be positively interpreted if it is related to more competitive markets where it is more difficult for incumbent firms to maintain high rents derived from market power. It could be a concern if it reflects lower investment in organisational capital and weaker brands for firms in non-OECD economies. However, when looking at the change in returns to intangible capital (measured and unmeasured) across production stages, the distribution stage is where the decrease is the smallest (Figure 4.7). It does not rule out the possibility that firms from non-OECD economies face more difficulties in achieving high mark-ups based on their brands but it suggests that it is more at the final production stage that there might be some under-investment in intangible capital.

Figure 4.7. Change in the share of returns to intangible capital by production stage in non-OECD economies

Manufacturing GVCs, percentage points, difference between the share of gross value added in 2015 and 2005

Note: Data are for all intangible capital (measured and unmeasured). The total change (in percentage points) is the sum of the change observed in each production stage (inputs, final production and distribution).

Source: Authors' calculations based on the OECD ICIO and national accounts.

4.3. Heterogeneity across GVCs

GVCs are organised differently across final products in terms of distribution of value added by production stage (Panel A in Figure 4.8) and shares of factor income (panel B). First, in some GVCs, a larger share of income is captured in the distribution stage. It is the case for textiles & apparel, other manufacturing (which includes furniture and toys) and food products. These GVCs are generally described as “buyer-driven” because the lead firm is a large retailer or a branded merchandiser, outsourcing the production process and capturing value in the distribution stage (Gereffi and Fernandez-Stark, 2016^[21]).

Figure 4.8. Share of value-added by production stage and distribution of factor income across GVCs

Source: Authors' calculations based on the OECD ICIO and national accounts.

In the “producer-driven” GVCs, the lead firm is on the contrary responsible for final production and may also control part of the production of processed inputs, with thus a higher share of value added before distribution. The other transport equipment industry (manufacturing of aircraft, ships, boats and railway locomotives) is in this category, as well as the motor vehicles industry. Figure 4.8 shows a different allocation of value added between final production and the production of inputs depending on the characteristics of the products manufactured but also the governance of the value chain.

For services, we do not observe important differences in the distribution of value added across productions stages, in particular because there is no distribution stage, except for some services such as publishing (books). Services are generally delivered directly to the consumer by the producer. But we can observe differences in the manufacturing sector when adding the inputs stage upstream and the distribution stage downstream. The shares of income going to intangible capital become higher, confirming the ‘smile curve’ from a factor income perspective.

Some heterogeneity is then observed in terms of returns to the different factors of production (Panel B in Figure 4.8). Telecoms is the industry with the highest share of returns coming from intangible capital (adding the measured and unmeasured parts), followed by finance & insurance. It highlights that services GVCs are also capital-intensive and sometimes more than manufacturing GVCs. Tangible capital also accounts for a significant share of factor income in services GVCs, especially in the transport & storage sector. It should be kept in mind that buildings are the main tangible assets and service activities require buildings, if not specific machinery and equipment. There is, however, some heterogeneity across services GVCs as IT services and other business services (which include professional services, technical testing, consulting and management services) are the GVCs with the highest labour shares, due to the employment of highly skilled professionals.

In manufacturing GVCs, there are high returns to intangible capital in the coke and petroleum industry, as well as chemicals (which include pharmaceuticals). But when looking only at measured intangible capital, publishing, audiovisual and broadcasting activities have the highest share of returns (because of entertainment, literary and artistic originals), followed by ICT & electronics and chemicals.

Looking now at how returns to intangible capital have changed in the different GVCs between 2005 and 2015 (Figure 4.9) and restricting the analysis to OECD countries (where the share of labour compensation has been more stable over the period), we can see that while overall there is an increase in the share of returns to intangible capital, it is not the case for six GVCs (out of 25): coke & petroleum, basic metal, transport & storage, hotels and restaurants, telecoms and other business services.

Figure 4.9 first provides some information on the production stage where returns to intangible capital have increased or decreased (Panel A). Leaving aside coke & petroleum where volatile oil prices and market power influence the results, the manufacturing GVCs with decreasing returns to intangibles in the inputs stage are industries like chemicals and ICT & electronics. In these GVCs, final producers capture a higher share of the income. But suppliers of inputs have increased returns in GVCs such as motor vehicles or other transport. In the case of motor vehicles, the literature highlights that a recent trend is the more prominent role of large suppliers (Van Biesebroeck and Sturgeon, 2010^[22]). Motor vehicles is a ‘producer-driven’ GVC and returns to intangible capital have also significantly increased in the final production stage. It could be associated with the digital transformation of the automotive industry and more technologies embodied in cars.

In the buyer-driven GVCs, such as textiles & apparel or other manufacturing, we see an increase in returns to intangible capital in the distribution stage. It is however not strong for food products, which is another buyer-driven GVC. Other industries more oriented towards the production of inputs and not really buyer-driven, such as paper & printing or rubber & plastics, also feature increased returns to intangibles in the distribution stage. In this case, it might be more related to technological evolutions such as the restructuring of the paper & printing industry in the context of the digital transformation. Rubber & plastics is also a GVC in transition with the environmental challenge.

For service GVCs, the distribution stage is by definition not accounting for a large share of returns (except in the publishing industry) but Panel A points out different trends. For hotels & restaurants, telecoms and other business services, there is a decrease in the share of intangibles in the final stage, while for construction and distribution the final stage captures a higher share of returns to intangibles (note that the final stage of production for distribution corresponds to the distribution stage in other GVCs).

Figure 4.9. Change in the share of returns to intangible capital across GVCs

OECD countries, percentage points, difference between the share in 2015 and 2005

Source: Authors' calculations based on the OECD ICIO and national accounts.

Panel B in Figure 4.9 provides additional information on how the overall change in returns to intangibles is split between returns to measured intangible capital (i.e. intangible assets accounted for in national accounts) and returns to unmeasured intangible capital (that we capture as a residual). There is no GVC where the share of returns to measured intangible capital has decreased, confirming that in all industries there is more investment in intellectual property products such as R&D and computer software and databases.⁵ When a GVC has an overall decrease in the share of returns to intangibles, it is always explained by the residual (the unmeasured intangible capital). GVCs where returns related to measured intangible capital have particularly increased are chemicals, ICT & electronics motor vehicles, other transport and machinery. These GVCs are not surprisingly the ones where more sophisticated products are developed in relation to the digital transformation. For services as well, higher returns on measured intangible capital are found in GVCs where the deployment of digital technologies is observed, such as publishing, audiovisual and broadcasting, telecoms, finance & insurance, and other business services.

5. Policies explaining patterns in returns to intangible capital

This part of the report empirically examines the links between returns to intangible capital in GVCs and a set of variables corresponding to two main policy areas. First, it relates estimates of returns to intangible capital to trade and investment policies. Second, it links estimates of returns to intangible capital to innovation policies and intellectual property rights. In addition, the analysis of these two policy areas is complemented by a brief exploration of the association between estimated returns to intangible capital and mark-ups.

The dependent variables in the regressions discussed in this section are country-industry level returns – either to intangible assets covered in the SNA (measured intangible capital) or to other intangibles not captured in the SNA (unmeasured intangible capital). In line with the GVC perspective previously presented, they were computed by summing all returns to the corresponding category of intangibles at the intermediate, final production and distribution stage. These estimated returns only take into account value added generated in the corresponding country.⁶ This approach ensures that these factor returns reflect value creation taking place in the country implementing the policies. Moreover, the regressions presented in this section are restricted to the manufacturing sector. To minimize the influence of special dynamics related to natural resources, the sector “coke and refined petroleum products” was excluded from the sample.⁷

⁵ Note that “intellectual property products” is the title of the category of assets in the System of National Accounts (2008) corresponding to intellectual property-intensive activities and products such as R&D and computer software and databases.

⁶ For example, the returns to tangible capital attributed to the French motor vehicles sector in this dataset do not count any returns to tangible capital associated with intermediate inputs imported by France from other countries. A failure to adopt such a value-added perspective would dilute the link between the economy where specific policies were introduced and the economy where the factor returns were generated.

⁷ In additional regressions reported in Annex B, we obtain similar results when excluding five sectors characterised by particularly high dependence on inputs sourced from natural resource sectors (Table A B.3 and Table A B.4). The picture also remains similar when we instead use a sample that excludes five sectors that display particularly strong forward linkages to natural resource sectors (not reported). Moreover, regressions based on the main sample but using the share of inputs sourced from natural resource sectors and the share of output sold to natural resource sectors as additional control variables (varying by country, industry and year) also provide similar results (Table A B.5 and Table A B.6).

It is important to note that policies are not assigned randomly to countries and inevitably reflect an economy's characteristics. The empirical strategy exploits the richness of the dataset created for this report by using a combination of fixed effects in order to address omitted variable bias. Three main dimensions of variation characterise the dataset used for this analysis: it provides estimates of returns to intangible capital that vary by country, industry, and year. The regression results presented in this section rely on variations of the following specification:

$$\log_rKi_{c,s,t} = \alpha_0 + \beta_1 \text{Determinant}_{c,(s),t-1} + \beta_3 Z_{c,t} + \delta_{cs} + \delta_{st} + \epsilon_{c,s,t}$$

where the dependent variable is the logarithm of the returns to intangibles in country c and industry s in year t . The key coefficient of interest is β_1 , it refers to an explanatory variable corresponding to one of the two policy areas outlined above. Depending on data availability, the variable might be measured at the country-industry level (e.g. tariffs) or the country-level (e.g. public funding of business R&D). Determinants are lagged by one year to mitigate endogeneity concerns, except for the STRI (not lagged) and the measure of intellectual property rights (IPR) protection (lagged by two years).⁸ Z refers to a vector of control variables. The latter encompasses the country's corporate income tax rate, natural resource rents as a percentage of GDP, the size of the shadow economy as a percentage of GDP and a measure of the effectiveness of the country's antimonopoly policy.

Based on OECD data, the corporate income tax rate variable is included in order to take into account the links between corporate strategies, intangibles in GVCs, and tax policies (Dischinger and Riedel, 2011^[23]; Kleinbard, 2011^[24]; Faulkender, Hankins and Petersen, 2019^[25]).⁹ The control for natural resource rents relies on the World Development Indicators dataset of the World Bank. Its inclusion helps to control for special dynamics related to non-produced assets in resource-rich economies. Estimates of the size of the shadow economy were taken from a dataset created by Wu and Schneider (2019^[26]). This variable is intended to control for the inherent difficulty of estimating factor returns for countries with a large informal economy. The data on the effectiveness of a country's antimonopoly policy come from the World Economic Forum and are based on a survey of experts. The incorporation of this control variable takes into account that the estimated returns to intangibles not covered in the SNA might partly capture rents that do not rely on knowledge assets, especially in economies characterized by poor anti-trust regulation.¹⁰

Country-by-industry fixed effects (δ_{cs}) control for the time-invariant part of characteristics that are specific to a given country-industry pair. For example, δ_{cs} capture a country's geographic location as well as the average level of product sophistication of industry s in country c during the period of analysis. Similarly, δ_{cs} would also control for time-invariant unobserved heterogeneity in the case where a specific management style or the natural resource endowments of country c shape the production processes of industry s in country c . In addition, industry-by-year fixed effects (δ_{st}) absorb all time-varying shocks to a specific industry in all countries in a given year, such as a drop in the price of textiles or a global crisis of the automotive sector.¹¹

⁸ The STRI is only available from 2014 onwards. As the coverage of the main dataset including estimates of returns to intangible capital stops in 2015, the STRI variable is not lagged. The IPR variable is lagged by two years, as it appears plausible to assume that changes in the design and enforcement of IPR legislation only slowly translate into changes regarding the creation of knowledge assets.

⁹ In robustness checks reported in Table A B.3 and Table A B.4, we also exclude a set of nine countries that have been highlighted in the literature on taxation and MNEs as playing a special role.

¹⁰ Due to its high correlation with the variable aimed at capturing the quality of IPR protection, the antimonopoly control is omitted from the regressions reported in columns 3 and 6 of Table 5.2.

¹¹ Notwithstanding the inclusion of these fixed effects and controls, this empirical strategy cannot fully address all endogeneity concerns (e.g. reverse causality). The results reported in this section therefore do not necessarily reflect causal relationships.

5.1. Economic openness

This section explores the association between the estimated returns to the two types of intangible assets and several policies related to economic openness regarding trade and investment. International trade is of pivotal importance to the development of economies, as governments pursue individual import and export strategies. Orchestrating the flows of knowledge, components, final products and capital between different locations, MNEs shape the continuously evolving architecture of GVCs (Iammarino and McCann, 2013^[27]). Policies affecting an economy's openness to trade and FDI can therefore be expected to influence the distribution of returns to intangible capital.

The regressions presented in Table 5.1 explore the relevance of three measures of a country's trade and investment policy with respect to returns to two types of intangible capital. Regarding tariffs, the table presents the coefficients of two alternative measures. The first tariff variable is the unweighted mean of the rates that are applied to products in the industry under observation. Yet, an industry's performance may also be affected by tariffs imposed on intermediate products that are formally attributed to another sector.¹² The set of regressions presented in Table 5.1 therefore also includes the unweighted mean of the tariffs a country applies to all manufacturing products.

The link between tariffs and the returns to intangibles covered by the SNA (measured intangible capital) is negative (columns 1 and 2), i.e. higher barriers to trade in goods are associated with lower returns to this category of intangible capital. Conversely, the relationship is positive (columns 5 and 6) in the case of returns to intangible capital inferred based on the residual approach (unmeasured intangible capital). The negative relation between tariffs and measured intangible capital (statistically significant in column 2 only) resonates with academic contributions highlighting the role of trade as a channel for knowledge diffusion and a powerful force incentivising firms to invest in knowledge creation. Policies restricting trade limit firms' ability to benefit from foreign knowledge. Conversely, the dismantling of trade barriers can generate opportunities to learn via importing (Grossman and Helpman, 1991^[28]; Mendoza, 2010^[29]; Park and Lippoldt, 2014^[30]; Colantone and Crinò, 2014^[31]). New export opportunities as well as import competition have been shown to induce firms to invest in knowledge creation (Bloom, Draca and Van Reenen, 2015^[32]; Coelli, Moxnes and Ulltveit-Moe, 2016^[33]; Utar and Ruiz, 2013^[34]; Coelli, Moxnes and Ulltveit-Moe, 2016^[33]; Utar and Ruiz, 2013^[34]).

The positive association between tariffs and returns to unmeasured intangibles (columns 5 and 6) could reflect that this residual might partly capture rents that are due to low levels of competition and might not be purely knowledge-based. Higher barriers to trade limit the entry of foreign competitors and therefore protect such rents. For example, a company specialised in cosmetics can be expected to reap continuously higher returns to its brand value if high tariffs limit consumers' ability to choose foreign products.

While tariffs affecting trade in goods frequently take centre stage in the debate about trade policies, there is a growing awareness of the importance of services as key inputs to manufacturing activities in GVCs (Miroudot and Cadestin, 2017^[35]; Andrenelli et al., 2018^[36]). Services inputs have been shown to enhance manufacturing firms' capacity of entering foreign markets (Berlingieri and Marcolin, 2018^[37]) and strengthen firms' ability to source foreign manufacturing inputs (Debaere, Görg and Raff, 2013^[38]). As a further dimension of policies shaping a country's economic openness, the results displayed in Table 5.1 therefore also relate a country's openness to services trade as measured by the OECD Services Trade Restrictiveness Index (STRI) to estimates of the returns to measured intangible capital (column 3) and unmeasured intangible capital (column 7). The STRI is a composite index that provides a snapshot of

¹² For example, tariffs applied to metal products that are formally attributed to the fabricated metals sector might also affect the motor vehicles sector that uses these products as inputs.

services regulatory regimes in 22 sectors across 46 countries, accounting for over 80% of global services trade.¹³

The results reveal a negative association between regulatory barriers to trade in services and returns to measured intangibles (column 3). This pattern suggests that access to foreign services inputs, e.g. computer services, is likely to influence firms' ability to generate returns to intangible assets covered in the SNA, such as software and databases. We similarly observe a statistically significant negative link between services trade restrictiveness and returns to unmeasured intangible assets (column 7). The approach employed to estimate returns to unmeasured intangible capital leaves the characteristics and origins of the rents captured by this residual in the dark. Our findings regarding this category of returns therefore have to be read carefully. The result reported in column 7 could reflect the relevance of services inputs to the types of knowledge-based assets that are not adequately captured by the SNA. Imports of foreign services can act as crucial inputs allowing firms to innovate and move up the quality ladder (Nordås, 2010^[39]). Services such as logistics or financial services can be expected to promote innovations, e.g. in terms of improvements of distribution strategies. Similarly, access to foreign providers of advanced IT services may enable manufacturing firms to implement superior customer relationship strategies.

As a further measure of a country's policies with respect to economic openness, Table 5.1 also reports regressions using the OECD FDI restrictiveness index as a measure of statutory restrictions on FDI. The corresponding coefficient is negative when employing estimated returns to measured intangible capital (column 4) as well as returns to unmeasured intangibles (column 8) as the dependent variable. The strong link between openness to FDI and returns to measured intangible assets, such as R&D, is in line with MNEs' role as the primary investors in business-funded innovative activities. In 2017 the top 2,500 companies investing the largest sums in R&D in the world accounted for roughly 90% of global business R&D, with Philips alone contributing approximately 40% of all patent filings in the Netherlands (Hernández et al., 2018^[40]).

At the same time, it is large MNEs such as Apple or Airbnb that have also been highlighted as major creators of returns to knowledge-based assets that are imperfectly captured in the SNA (WIPO, 2017^[18]). The negative coefficient in column 8 seems in line with a scenario where barriers to FDI reduce the returns to intangible capital not recorded in the SNA, such as superior distribution strategies and brand identities. However, since returns to unmeasured intangible capital were estimated as a residual, alternative ways of reading this finding cannot be ruled out.

Overall, this exploration of the relevance of several dimensions of openness to trade and investment has revealed a nuanced picture. Greater openness is associated with higher returns to measured intangible capital. The picture is less clear-cut with respect to returns to unmeasured intangibles. On the one hand, higher tariffs on goods appear to shield incumbents from competition and thereby increase this type of returns. Conversely, barriers to trade in services as well as restrictions on FDI seem to reduce the returns to unmeasured intangibles, such as ownership of data on consumer preferences, that increasingly characterise modern strategies of MNEs. Regarding returns to unmeasured intangible capital, the possibility that this residual captures returns derived from knowledge assets as well as rents related to barriers to competition complicates the interpretation of our results. The contrast between the coefficients of the two tariff variables (columns 5 and 6) and those of the variables capturing barriers to services trade and investment (columns 7 and 8) is likely to reflect the heterogeneity of the types of rents captured by this residual category and warrants further attention in future research.

¹³ For a given country, the average STRI score across the 22 services sectors included in the STRI was computed. To obtain a measure that varies across manufacturing industries, this average STRI score was then weighted by each manufacturing industry's services input share.

Table 5.1. Economic openness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.005 (0.003)				0.010** (0.004)			
Unweighted tariff (all manufacturing)		-0.014*** (0.005)				0.012* (0.007)		
STRI			-33.999*** (7.774)				-15.492** (6.509)	
FDI restrictiveness				-21.597*** (6.091)				-23.139*** (7.044)
Observations	6,157	5,956	1,233	3,358	6,157	5,956	1,233	3,358
R-squared	0.249	0.248	0.266	0.087	0.175	0.176	0.177	0.075
Country-industry combinations	788	788	620	685	788	788	620	685

Note: Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported. Table A B.1. reports the same regressions with the coefficients of the control variables.

5.2. Innovation policies

Economic theory suggests that knowledge spillovers provide a strong rationale for public interventions aimed at increasing investment in R&D as well as training. Governments around the world therefore employ a diverse mix of policies to support R&D activities and incentivise firms and workers to invest in the search for new ideas.¹⁴ Table 5.2. presents the results of regressions linking three types of innovation-related policies to the estimated returns to measured intangible capital (columns 1-3) and unmeasured intangibles (columns 4-6).¹⁵

R&D tax subsidies are increasingly used as a policy instrument aimed at incentivising firms to invest in knowledge creation (OECD, 2018^[41]). The first independent variable listed in Table 5.2. , the R&D tax subsidy for SMEs, is an example of such an indirect type of R&D support. The coefficient in column 1 is positive and statistically significant. As R&D is part of the intangible assets included in the SNA (measured intangible capital), this finding is in line with empirical studies demonstrating such instruments' effectiveness in increasing firms' R&D spending (Chang, 2018^[42]; Bøler, Moxnes and Ulltveit-Moe, 2015^[43]; Dechezleprêtre et al., 2016^[44]). The coefficient remains positive but is no longer statistically significant when using the estimated returns to intangibles not captured by the SNA (unmeasured intangible capital) as the dependent variable (column 6). The results therefore show that R&D tax subsidies appear to increase the R&D efforts reported by firms, but these subsidies might not necessarily lead to the generation of intangible assets beyond those captured in the SNA. However, the heterogeneity of the type of rents captured by the residual approach used to estimate returns to unmeasured intangible

¹⁴ Since the 1980s, the conceptualisation of knowledge creation as a linear sequencing of basic research, applied research and the introduction of innovative products has given way to a systemic perspective emphasising interactions between innovative agents (Caraça, Lundvall and Mendonça, 2009^[80]). However, policies aimed at strengthening network linkages are not easy to quantify and therefore not included in this part of the analysis. Notwithstanding the importance of a systemic view of innovation processes, supply-focused measures aimed at increasing R&D activity continue to play a central role in the design of modern innovation policies (Edler and Fagerberg, 2017^[81]).

¹⁵ Information on tax subsidies for SMEs and government funding of business R&D comes from the OECD, whereas the IPR protection variable relies on an expert survey conducted by the World Economic Forum.

capital may limit our ability to precisely identify the effect of this policy instrument on returns to intangibles not included in the SNA.

In addition to R&D tax subsidies, governments also directly finance R&D conducted by business enterprises. Examples of such funding are the grants provided in the United Kingdom by the UK Research Councils or by the Small Business Innovation Research (SBIR) in the United States. This type of government support typically involves agencies and expert commissions in charge of evaluating proposals focused on specific innovation projects. The link between this type of R&D support and returns to measured intangible capital is positive and strongly significant (column 2). As R&D is part of the set of intangible assets captured in the SNA, this result is in line with expectations.

Interestingly, the coefficient is even larger and still statistically significant when exploring the link with returns to unmeasured intangible capital (column 5). The estimate indicates that, assuming no other variables change, an increase of government funding of business R&D relative to GDP by 10 percentage points would be associated with an increase of returns to unmeasured intangibles by 20%.¹⁶

This finding therefore suggests that public funding of firms' R&D activities also supports the creation of intangible assets not captured by the SNA. For example, a producer of household appliances might obtain public R&D funding for the new design of vacuum cleaners involving innovative technologies. While this R&D support may appear primarily linked to assets recorded in the SNA, such as R&D itself and intellectual property rights, the brand identity tailored to this new product and the corresponding distribution and marketing strategy might enable the firm to reap additional returns.¹⁷

Beyond financial support of investment in knowledge creation, policy-makers can influence the creation of knowledge-based assets through the protection and enforcement of IPRs. Knowledge is non-rival and only to a limited extent excludable. An institutional framework protecting the rights of owners of knowledge assets is therefore of pivotal importance to the incentives to invest in the creation of knowledge. Rather than just the formal IPR legislation, it is also the trust in the enforcement of laws and regulations that encourages individuals and firms to invest in innovative activities. In the case of Indonesia, for example, companies' lack of confidence in the IPR system has been described as a factor limiting their efforts to obtain IPRs (OECD, 2013^[45]).¹⁸

Table 5.2 also reports results of regressions exploring the link between the quality of IPR protection (lagged by two years) as measured by an expert survey conducted by the World Economic Forum and returns to measured intangible assets (column 3) and unmeasured intangibles (column 6). The coefficient is positive and statistically significant when using returns to measured intangibles as the dependent variable (column 3). This finding is in line with the idea that a strong protection and enforcement of IPRs enhances firms' ability to reap returns to investment in knowledge creation.

¹⁶ This can be calculated as $\exp(0.1 * 1.861) - 1$.

¹⁷ However, one cannot rule out – based on the results presented in column 5 of Table 5.2 – that government funding of business R&D may also contribute to an increase in returns that do not rely on knowledge assets. The residual approach employed to estimate returns to unmeasured intangible capital prevents us from disentangling Schumpeterian returns to knowledge-based assets not recorded in the SNA from other returns associated with market power that is not based on intangible capital.

¹⁸ Table A B.6 in the annex reports the regression results showing that intellectual property right (IPR) intensity is a strong industry-level predictor of returns to intangibles.

Table 5.2. Innovation policies

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.322*** (0.057)			0.135 (0.099)		
Government funding of business R&D (share of GDP)		1.376*** (0.203)			1.861*** (0.397)	
Quality of IPR protection (higher=stronger protection)			0.033** (0.017)			-0.073** (0.030)
Observations	4,630	4,319	5,348	4,630	4,319	5,348
R-squared	0.200	0.194	0.239	0.176	0.194	0.189
Country-industry combinations	595	636	783	595	636	783

Note: Standard errors clustered at country-industry level. All regressions include country-industry fixed effects, industry-year fixed effects and three controls (corporate income tax rate, natural resource rents, shadow economy). In addition, columns 1, 2, 4 and 5 also control for antimonopoly regulation. The constant is not reported. Table A B.2 reports the same regressions with the coefficients of the control variables.

Conversely, column 6 shows that the quality of IPR protection is negatively correlated with returns to unmeasured intangible assets. When interpreting this finding, one has to take into account that formal property rights are captured in the SNA, i.e. the estimate referring to unmeasured intangible capital captures returns to assets that in many cases will not be protected by formal IPRs. In addition, the quality of IPR protection tends to be correlated with other dimensions of the quality of regulation and governance.¹⁹ Since the returns to unmeasured intangible assets are estimated based on a residual approach, they may also partly capture rents associated with market power in a context of poor antitrust regulation. If countries improving the protection of IPRs simultaneously achieve progress regarding the rule of law or antimonopoly policies, this can explain why the coefficient in column 6 indicates that a strengthening of the IPR protection is linked to lower returns to unmeasured intangible assets.

5.3. Intangible capital and mark-ups

Intangible capital figures prominently in the recent debate about signs that the gap between the most productive firms and firms lagging behind the productivity frontier appears to be widening. The growing relevance of intangibles as well as the enhanced capacity of leading firms (so-called “superstar firms”) to prevent the diffusion of valuable knowledge have been highlighted as potential drivers of growing market concentration rates observed in several industries and countries (Bahar, 2018^[46]; Grullon, Larkin and Michaely, 2019^[47]; Calligaris, Criscuolo and Marcolin, 2018^[48]; De Loecker and Eeckhout, 2018^[49]; Bajgar et al., 2019^[50]). At the same time, a reduction in the labour income share in advanced economies has been highlighted (Autor et al., 2017^[51]). The prevalence and causes of these trends remain contested and the literature investigating these patterns is still at a nascent stage (Cette, Koehl and Philippon, 2019^[52]; Cho, Hwang and Schreyer, 2017^[53]; Gutiérrez and Piton, 2019^[54]; Pike, 2018^[55]).

¹⁹ For example, in our dataset the IPR variable displays a relatively high correlation (0.83) with the variable aimed at capturing the effectiveness of antimonopoly policy. Due to this high correlation, the control for the effectiveness of antimonopoly regulation was not included in columns 3 and 6. When entering this additional control, the coefficient of the IPR variable loses significance in columns 3 as well as 6 (not reported).

Calligaris, Criscuolo and Marcolin (2018^[48]) identify an increase in average markups during 2001-2014 in a sample of 26 countries. This trend is driven by firms at the top of the markup distribution, whereas firms in the bottom half of the distribution display a flat trend during this period. In a recent contribution that examines the link between mark-ups and intangibles based on US data, Crouzet and Eberly (2019^[56]) find a positive link between a firm's intangible capital intensity and its market share. These authors similarly observe a positive link between a firm's intangible intensity and its mark-up.

An in-depth exploration of these aspects would be beyond the scope of this paper. Nevertheless, a dataset created as part of the OECD Going Digital initiative by Calligaris, Criscuolo and Marcolin (2018^[48]) allows for a brief exploration of the general link between mark-ups and returns to intangible capital. The debate about superstar firms highlights differences within the population of firms, with leading firms appearing to translate their ownership of superior knowledge assets into growing market shares. As mark-ups capture market concentration, one might expect a positive link between the returns to intangibles and the gap between firms with the highest mark-ups and the "laggards". A set of regressions explores this idea by using the difference between the 90th percentile and the 10th percentile of the mark-up distribution (Table 5.3). As this analysis exploits variation in mark-up distributions, the control for the effectiveness of antimonopoly policy is initially omitted from these regressions.

Table 5.3 displays the link between the "mark-up gap" variable and the two categories of returns to intangible assets at four different levels. Columns 1 and 5 employ dependent variables at the country-industry level (as in Table 5.1 and Table 5.2) that are the sum of the returns to the corresponding category of returns to intangible assets at the intermediate, final production and distribution stage. In addition, Table 5.3 also lists results of regressions using dependent variables that only take into account the returns generated in a given country and industry at the intermediate (columns 2 and 6), final (columns 3 and 7) or distribution stage (columns 4 and 8).

Table 5.3. Returns to intangible capital and mark-ups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Measured intangible capital				Unmeasured intangible capital			
	Overall	Intermediate	Final	Distribution	Overall	Intermediate	Final	Distribution
Lagged logarithm of mark-up gap	0.009	0.010	0.003	0.023***	0.028*	0.024**	0.125**	0.037*
	(0.013)	(0.012)	(0.015)	(0.008)	(0.015)	(0.010)	(0.057)	(0.021)
Observations	2,795	2,795	2,795	2,795	2,795	2,795	2,795	2,795
R-squared	0.405	0.334	0.322	0.395	0.244	0.320	0.145	0.103
Country-industry combinations	321	321	321	321	321	321	321	321

Note: The mark-up gap was calculated as the mark-up at the 90th percentile (of the mark-up distribution in a given country and industry) minus the mark-up at the 10th percentile. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects, industry-year fixed effects and three controls (corporate income tax rate, natural resource rents, shadow economy).

Source: Own estimations.

The coefficient of the mark-up gap variable is always positive, but it is not statistically significant in columns 1-3. This overall pattern resembles the findings of Crouzet and Eberly (2019^[56]) who identify a positive link between intangible intensity and mark-ups at the firm-level and industry-level for the United States. The strongly significant positive association between the mark-up gap and returns to measured intangibles at the distribution stage (column 4) is in line with a situation where firms with particularly high mark-ups reap the returns to their ownership of intangibles especially at the distribution stage.

When adding the control for a country's quality of antitrust legislation (see in the annex), the mark-up gap variable's coefficient is no longer statistically significant in columns 1-7 but remains marginally significant in column 8. This contrast points to the important role of competition authorities. In light of contributions stressing the link between ownership of intangible assets and market power (Durand and Milberg, 2019^[57];

Crouzet and Eberly, 2019^[56]), the brief analysis presented in this section provides tentative support for a strengthening of antitrust authorities' capacity to monitor market concentration trends as recommended by Pike (2018^[55]). A more comprehensive consideration of the distribution of intangible assets could contribute to a better understanding of the drivers of changes in market concentration.

6. Concluding remarks

This report has introduced initial observations derived from the joint DAF-STI-TAD project on *Trade, Investment and Intangibles: Adapting to New Business Strategies*. By combining comprehensive information on factor income in the OECD ICIO and TiVA database, the report pursues a deeper analysis of GVCs. Complementing earlier work focusing on ways of promoting participation in GVCs, it provides insights into the way value is captured and the policies affecting income distribution.

Keeping in mind that there are limitations in the methodology used to derive estimates of returns to intangible capital in a large panel of countries and industries, the main findings of the report are:

- Intangible capital accounts for about 27% of income in global value chains (manufacturing and business services). The rest of value added is split between labour income (54%), returns to tangible capital (17%) and taxes minus subsidies on production (3%).
- Intangible assets reported in national accounts only explain 6 percentage points of the 27% of income accruing to intangible capital. Most of the income derived from intangible assets is not captured and can only be measured through a residual approach.
- In OECD countries, returns to intangible capital have increased in the period studied (2005-2015) in manufacturing GVCs while the share of income going to labour has decreased. In services GVCs, we do not observe the same decline in the labour share and the share of intangible capital has been stable. However, there is an increase in the share of the measured intangible capital suggesting more investment in R&D, software and databases and artistic originals in services industries (which are the intangible assets captured in national accounts).
- In non-OECD economies, wages are catching up and there is an increase in the share of income going to labour with a smaller share of income accruing to intangible capital. However, in absolute terms, returns to intangible capital have also increased and the growth rate of returns to measured intangible capital is similar to the growth rate of the labour share. Emerging economies are not lagging behind in the accumulation of intangible capital.
- There are important differences across GVCs in the way factors of production are remunerated based on the industry and the way the GVC is organised. A significant share of income is captured in the distribution stage, particularly in buyer-driven value chains (e.g. textiles and apparel) where we see an increase in returns to intangible capital at the end of the value chain. But in some producer-driven value chains (e.g. motor vehicles), we see on the contrary an increase in returns to intangible capital at the final stage of production and not in the distribution stage.
- Openness to trade and investment acts as an important determinant of patterns in returns to intangible capital in GVCs, especially regarding intangibles recorded in the national accounts. Lower tariffs and greater openness to foreign direct investments are positively associated with returns to this category of intangible capital. This pattern is also clearly visible in the case of restrictions affecting services trade. This suggests that specialised foreign services inputs enhance firms' capabilities to develop and improve business strategies based on intangible capital.

- The picture regarding the link between economic openness and returns to intangibles not recorded in the national accounts is less clear-cut. On the one hand, higher tariffs on goods appear to shield incumbents from competition and thereby increase this type of returns. Conversely, barriers to trade in services as well as restrictions on FDI seem to reduce the returns to unmeasured intangibles, such as ownership of data on consumer preferences, that increasingly characterise modern strategies of MNEs. While these results are confirmed by several robustness checks, future improvements in terms of data availability may allow for a more detailed exploration of these aspects, especially regarding returns to unmeasured intangible capital.
- There is evidence of a positive association between public support for business R&D and returns to intangible capital. While R&D tax subsidies primarily appear to increase returns to intangibles assets recorded in national accounts, the direct public funding of R&D conducted by businesses seems to be associated with higher returns to measured intangible capital as well as returns to intangible capital not recorded in the national accounts.
- The results demonstrate that heterogeneity in the quality of protection of intellectual property rights is an important factor shaping the distribution of returns to intangibles in GVCs. Regarding returns to intangible assets recorded in national accounts, the findings suggest that IPR policies are efficient tools enabling firms to derive higher income from their intangible assets.
- With respect to the recent debate about market concentration and “superstar firms”, the exploratory results presented in this paper suggest that the size of the difference between the firms at the bottom and the top of the mark-up distribution is relevant. This mark-up gap predicts returns to intangible capital, but this association is no longer statistically significant when a country’s effectiveness of antimonopoly legislation is taken into account. This suggests that a more comprehensive consideration of the distribution of intangible assets could contribute to a better understanding of the drivers of changes in market concentration.

References

- Ahn, S. (ed.) (2014), *Channels of technology transfer and intellectual property rights in developing countries.*, Cheltenham, UK : Edward Elgar. [30]
- Andrenelli, A. et al. (2018), "Multinational production and trade in services", *OECD Trade Policy Papers*, No. 212, OECD Publishing, Paris, <https://dx.doi.org/10.1787/16ec6b55-en>. [36]
- Andrews, D., C. Criscuolo and P. Gal (2016), "The Best versus the Rest: The Global Productivity Slowdown, Divergence across Firms and the Role of Public Policy", *OECD Productivity Working Papers*, No. 5, OECD Publishing, Paris, <https://dx.doi.org/10.1787/63629cc9-en>. [15]
- Autor, D. et al. (2017), "The fall of the labor share and the rise of superstar firms", *NBER Working Paper*, No. 23396, <https://www.nber.org/papers/w23396>. [51]
- Bahar, D. (2018), "The middle productivity trap: Dynamics of productivity dispersion", *Economics Letters*, Vol. 167, pp. 60-66, <http://dx.doi.org/10.1016/j.econlet.2018.02.028>. [46]
- Bajgar, M. et al. (2019), "Industry Concentration in Europe and North America", *OECD Productivity Working Papers*, No. 18, OECD Publishing, Paris, <https://dx.doi.org/10.1787/2ff98246-en>. [50]
- Baldwin, J., H. Liu and M. Tanguay (2015), "An Update on Depreciation Rates for the Canadian Productivity Accounts", *The Canadian Productivity Review*. [75]
- Baldwin, R., T. Ito and H. Sato (2014), "The smile curve: Evolving sources of value added in manufacturing", *Joint Research Program Series*, IDE-JETRO. [10]
- Banerjee, A. and E. Duflo (2005), "Chapter 7 Growth Theory through the Lens of Development Economics", in *Handbook of Economic Growth*, Elsevier, [http://dx.doi.org/10.1016/s1574-0684\(05\)01007-5](http://dx.doi.org/10.1016/s1574-0684(05)01007-5). [69]
- Barkai, S. (2016), "Declining labor and capital shares", *Stigler Center for the Study of the Economy and the State New Working Paper Series 2*. [70]
- Bernard, A. and T. Fort (2015), "Factoryless Goods Producing Firms", *American Economic Review*, Vol. 105/5, pp. 518-523, <http://dx.doi.org/10.1257/aer.p20151044>. [11]
- Bloom, N., M. Draca and J. Van Reenen (2015), "Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity", *The Review of Economic Studies*, Vol. 83/1, pp. 87-117, <http://dx.doi.org/10.1093/restud/rdv039>. [32]
- Bøler, E., A. Moxnes and K. Ulltveit-Moe (2015), "R&D, International Sourcing, and the Joint Impact on Firm Performance", *American Economic Review*, Vol. 105/12, pp. 3704-3739, <http://dx.doi.org/10.1257/aer.20121530>. [43]
- Calligaris, S., C. Criscuolo and L. Marcolin (2018), "Mark-ups in the digital era", *OECD Science, Technology and Industry Working Papers*, No. 2018/10, OECD Publishing, Paris, <https://dx.doi.org/10.1787/4efe2d25-en>. [48]
- Caraça, J., B. Lundvall and S. Mendonça (2009), "The changing role of science in the innovation process: From Queen to Cinderella?", *Technological Forecasting and Social Change*, Vol. 76/6, pp. 861-867, <http://dx.doi.org/10.1016/j.techfore.2008.08.003>. [80]
- Caselli, F. and J. Feyrer (2007), "The Marginal Product of Capital*", *The Quarterly Journal of Economics*, Vol. 122, pp. 535-568, <http://dx.doi.org/10.1162/qjec.122.2.535>. [63]

- Cette, G., L. Koehl and T. Philippon (2019), "Labor Shares in Some Advanced Economies.", *NBER Working Paper*, No. 26136, <https://www.nber.org/papers/w26136>. [52]
- Chang, A. (2018), "Tax policy endogeneity: evidence from R&D tax credits", *Economics of Innovation and New Technology*, Vol. 27/8, pp. 809-833, <http://dx.doi.org/10.1080/10438599.2017.1415001>. [42]
- Chen, W. et al. (2017), "Measuring the income to intangibles in goods production: a global value chain approach", *Economic Research Working Paper*, No. 36, World Intellectual Property Organization. [13]
- Chen, W., B. Los and M. Timmer (2018), "Factor Incomes in Global Value Chains: The Role of Intangibles", *NBER Working Paper*, No. 25242, <http://www.nber.org/papers/w25242>. [12]
- Cho, T., S. Hwang and P. Schreyer (2017), "Has the Labour Share Declined?: It Depends", *OECD Statistics Working Papers*, No. 2017/1, OECD Publishing, Paris, <https://dx.doi.org/10.1787/2dcfc715-en>. [53]
- Coelli, F., A. Moxnes and K. Ulltveit-Moe (2016), "Better, faster, stronger: Global innovation and trade liberalization", *NBER Working Paper*, No. 22647, <https://www.nber.org/papers/w22647>. [33]
- Colantone, I. and R. Crinò (2014), "New imported inputs, new domestic products", *Journal of International Economics*, Vol. 92/1, pp. 147-165, <http://dx.doi.org/10.1016/j.jinteco.2013.10.006>. [31]
- Corrado, C., C. Hulten and D. Sichel (2005), "Measuring Capital and Technology: An Expanded Framework", in Corrado, C., J. Haltiwanger and D. Sichel (eds.), *Measuring Capital in the New Economy*, University of Chicago Press, Chicago. [6]
- Crouzet, N. and J. Eberly (2019), *Understanding weak capital investment: The role of market concentration and intangibles*, <https://www.nber.org/papers/w25869>. [56]
- Damodaran, A. (2019), *Costs of Capital by Industry Sector*, http://people.stern.nyu.edu/adamodar/New_Home_Page/datacurrent.html#discrate (accessed on 28 August 2019). [71]
- David, J., E. Henriksen and I. Simonovska (2014), *The Risky Capital of Emerging Markets*, <http://dx.doi.org/10.3386/w20769>. [64]
- De Loecker, J. and J. Eeckhout (2018), *Global market power*, <https://www.nber.org/papers/w24768>. [49]
- Debaere, P., H. Görg and H. Raff (2013), "Greasing the wheels of international commerce: how services facilitate firms' international sourcing", *Canadian Journal of Economics/Revue canadienne d'économique*, Vol. 46/1, pp. 78-102, <http://dx.doi.org/10.1111/caje.12006>. [38]
- Dechezleprêtre, A. et al. (2016), *Do tax Incentives for Research Increase Firm Innovation? An RD Design for R&D*, <https://www.nber.org/papers/w22405>. [44]
- Dedrick, J., K. Kraemer and G. Linden (2010), "Who profits from innovation in global value chains?: a study of the iPod and notebook PCs", *Industrial and Corporate Change*, Vol. 19/1, pp. 81-116, <http://dx.doi.org/10.1093/icc/dtp032>. [4]
- Dischinger, M. and N. Riedel (2011), "Corporate taxes and the location of intangible assets within multinational firms", *Journal of Public Economics*, Vol. 95/7-8, pp. 691-707, <http://dx.doi.org/10.1016/j.jpubeco.2010.12.002>. [23]
- Durand, C. and W. Milberg (2019), "Intellectual monopoly in global value chains", *Review of International Political Economy*, pp. 1-26, <http://dx.doi.org/10.1080/09692290.2019.1660703>. [57]
- Edler, J. and J. Fagerberg (2017), "Innovation policy: what, why, and how", *Oxford Review of Economic Policy*, Vol. 33/1, pp. 2-23, <http://dx.doi.org/10.1093/oxrep/grx001>. [81]
- EUIPO and EPO (2016), *Intellectual property rights intensive industries and economic performance in the European Union, Second edition*. [79]

- European Commission, IMF, OECD, United Nations and World Bank (2008), *System of National Accounts*. [61]
- Evans, D. (2003), "Fixed Assets and Consumer Durable Goods in the United States, 1925-97", *US Department Of Commerce. Bureau of Economic Analysis*, https://apps.bea.gov/national/pdf/Fixed_Assets_1925_97.pdf. [74]
- EY (2018), *Worldwide Capital and Fixed Assets Guide*, <https://www.ey.com/Publication/vwLUAssets/ey-2018-worldwide-capital-and-fixed-assets-guide/FILE/ey-2018-worldwide-capital-and-fixed-assets-guide.pdf>. [76]
- Faulkender, M., K. Hankins and M. Petersen (2019), "Understanding the Rise in Corporate Cash: Precautionary Savings or Foreign Taxes", *The Review of Financial Studies*, Vol. 32/9, pp. 3299-3334, <http://dx.doi.org/10.1093/rfs/hhz003>. [25]
- Gereffi, G. (2019), "Global value chains and international development policy: Bringing firms, networks and policy-engaged scholarship back in", *Journal of International Business Policy*, <http://dx.doi.org/10.1057/s42214-019-00028-7>. [1]
- Gereffi, G. and K. Fernandez-Stark (2016), *Global Value Chain Analysis: A Primer. Second Edition.*, Duke Center on Globalization, Governance and Competitiveness. [21]
- Görzig, B. (2005), "Depreciation in EU Member States - Empirical and Methodological Differences", *DIW Berlin*. [73]
- Grossman, G. and E. Helpman (1991), *Innovation and Growth in the Global Economy.*, Cambridge, MA: MIT Press. [28]
- Grullon, G., Y. Larkin and R. Michaely (2019), "Are US Industries Becoming More Concentrated?", *Review of Finance*, Vol. 23/4, pp. 697-743, <http://dx.doi.org/10.1093/rof/rfz007>. [47]
- Gutiérrez, G. and S. Piton (2019), "Revisiting the global decline of the (non-housing) labor share", *Bank of England Staff Working Paper*, No. 811. [54]
- Hanson, G. (2010), "Why Isn't Mexico Rich?", *Journal of Economic Literature*, Vol. 48, pp. 987-1004, <http://dx.doi.org/10.2307/29779707>. [66]
- Haskel, J. and S. Westlake (2018), *Capitalism without capital : the rise of the intangible economy*, Princeton University Press. [7]
- Hernández, H. et al. (2018), *The 2018 EU Industrial R&D Investment Scoreboard*, <http://dx.doi.org/10.2760/131813>. [40]
- Hulten, C. (2010), "Decoding Microsoft: Intangible Capital as a Source of Company Growth", *NBER Working Papers*, National Bureau of Economic Research, Cambridge, MA, <http://dx.doi.org/10.3386/w15799>. [8]
- Iammarino, S. and P. McCann (2013), *Multinationals and Economic Geography: Location, Technology and Innovation.*, Cheltenham, U.K. and Northampton, Massachusetts: Edward Elgar. [27]
- ILO (2019), *The global labour income share and distribution*. [59]
- Inklaar, R., P. Woltjer and D. Albarran (2019), "The Composition of Capital and Cross-Country Productivity Comparisons", *International Productivity Monitor*, pp. 34-52, https://www.rug.nl/ggdc/docs/pwt91_capitalservices_ipmrevision.pdf. [65]
- Jäger, K. (2017), "EU KLEMS Growth and Productivity Accounts 2017 Release, Statistical Module", *The Conference Board*. [72]
- Jorgenson, D. and Z. Griliches (1967), "The Explanation of Productivity Change", *The Review of Economic Studies*, Vol. 34, p. 249, <http://dx.doi.org/10.2307/2296675>. [60]

- Karabarbounis, L. and B. Neiman (2014), "The Global Decline of the Labor Share", *The Quarterly Journal of Economics*, Vol. 129/1, pp. 61-103, <http://dx.doi.org/10.1093/qje/qjt032>. [19]
- Kleinbard, E. (2011), "Stateless income", *Florida Tax Review*, Vol. 11/9. [24]
- Kohler, W. and E. Yalcin (eds.) (2018), *Export Dynamics and the Sourcing of Service Inputs*, MIT Press. [37]
- Le Mouel, M. and M. Squicciarini (2015), "Cross-Country Estimates of Employment and Investment in Organisational Capital: A Task-Based Methodology Using Piac Data", *OECD Science, Technology and Industry Working Papers*, No. 2015/8, OECD Publishing, Paris, <https://dx.doi.org/10.1787/5jrs3smfgcjb-en>. [5]
- Li, W. and B. Hall (2018), "Depreciation of Business R&D Capital", *Review of Income and Wealth*, Vol. 66/1, pp. 161-180, <http://dx.doi.org/10.1111/roiw.12380>. [78]
- McKenzie, D. and C. Woodruff (2008), "Experimental Evidence on Returns to Capital and Access to Finance in Mexico", *World Bank Economic Review*, Vol. 22, pp. 457-482, <http://dx.doi.org/10.1093/wber/lhn017>. [67]
- Mendoza, R. (2010), "Trade-induced Learning and Industrial Catch-up", *The Economic Journal*, Vol. 120/546, pp. F313-F350, <http://dx.doi.org/10.1111/j.1468-0297.2010.02379.x>. [29]
- Miller, R. and P. Blair (2009), *Input-Output Analysis*, Cambridge University Press. [62]
- Miroudot, S. and C. Cadestin (2017), "Services In Global Value Chains: From Inputs to Value-Creating Activities", *OECD Trade Policy Papers*, No. 197, OECD Publishing, Paris, <https://dx.doi.org/10.1787/465f0d8b-en>. [35]
- Mudambi, R. (2007), "Offshoring: Economic Geography and the Multinational Firm", *Journal of International Business Studies*, Vol. 38/1, p. 206, https://www.jstor.org/stable/4540411?seq=1#metadata_info_tab_contents. [9]
- Nordås, H. (2010), "Trade in goods and services: Two sides of the same coin?", *Economic Modelling*, Vol. 27/2, pp. 496-506, <http://dx.doi.org/10.1016/j.econmod.2009.11.002>. [39]
- OECD (2018), *OECD Review of national R&D tax incentives and estimates of R&D tax subsidy rates, 2017*, <http://www.oecd.org/sti/rd-tax-stats-design-subsidy.pdf>. [41]
- OECD (2015), *OECD Science, Technology and Industry Scoreboard 2015: Innovation for growth and society*, OECD Publishing, Paris, https://dx.doi.org/10.1787/sti_scoreboard-2015-en. [17]
- OECD (2013), *Innovation in Southeast Asia*, OECD Reviews of Innovation Policy, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264128712-en>. [45]
- OECD (2013), *Interconnected Economies: Benefiting from Global Value Chains*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264189560-en>. [2]
- OECD (2013), *Supporting Investment in Knowledge Capital, Growth and Innovation*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264193307-en>. [14]
- OECD (2006), *Creating value from intellectual assets*. [16]
- Pike, C. (2018), "Market Concentration", *OECD Issues paper DAF/COMP/WD(2018)46*. [55]
- Pionnier, P. and E. Guidetti (2015), "Comparing profit shares in value-added in four OECD countries", <https://doi.org/10.1787/5js0bsm2g0lt-en>. [58]

- Schwellnus, C. et al. (2018), "Labour share developments over the past two decades: the role of technological progress, globalisation and 'winner-takes-most' dynamics", *Economics Department Working Papers*, No. 1503, OECD, <http://www.oecd.org/eo/workingpapers>. [20]
- Udry, C. and S. Anagol (2006), *The Return to Capital in Ghana*, <https://EconPapers.repec.org/RePEc:egc:wpaper:932>. [68]
- Ugur, M. et al. (2016), "R&D and productivity in OECD firms and industries: A hierarchical meta-regression analysis", *Research Policy*, Vol. 45/10, pp. 2069-2086, <http://dx.doi.org/10.1016/j.respol.2016.08.001>. [82]
- Utar, H. and L. Ruiz (2013), "International competition and industrial evolution: Evidence from the impact of Chinese competition on Mexican maquiladoras", *Journal of Development Economics*, Vol. 105, pp. 267-287, <http://dx.doi.org/10.1016/j.jdeveco.2013.08.004>. [34]
- Van Biesebroeck, J. and T. Sturgeon (2010), "Effects of the 2008-09 Crisis on the Automotive Industry in Developing Countries: A Global Value Chain Perspective", in Cattaneo, O., G. Gereffi and C. Staritz (eds.), *Global Value Chains in a Postcrisis World: A Development Perspective*, World Bank. [22]
- WB (2011), *The Changing Wealth of Nations - Measuring Sustainable Development in the New Millennium*. [77]
- WIPO (2017), *World Intellectual Property Report 2017. Intangible Capital in Global Value Chains*, World Intellectual Property Organization, Geneva, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_944_2017.pdf. [18]
- Wu, D. and F. Schneider (2019), "Nonlinearity Between the Shadow Economy and Level of Development", *IMF Working Paper*, Vol. No. 19/48. [26]
- Xing, Y. and N. Detert (2010), "How the iPhone Widens the United States Trade Deficit with the People's Republic of China", *ADB Working Papers*, No. 257, <http://dx.doi.org/10.2139/ssrn.1729085>. [3]

Annex A. Methodology used to estimate returns to intangible capital and robustness checks

This annex provides additional information on the methodology used to estimate returns to intangible capital in global value chains (GVCs). The estimation takes place within the framework of the OECD Inter-Country Input-Output (ICIO) tables that are the underlying data of the Trade in Value Added (TiVA) database. The OECD ICIO is benchmarked on national accounts and provides in a unified and harmonised framework the output, final demand, value added and intermediate consumption of 36 industries in 64 countries plus a 'rest of the world' over the period 2005-2015.²⁰ The international input-output structure of the ICIO is used to look at factor income with a GVC approach as in Chen et al. (2017^[13]; 2018^[12]).

The income approach to GDP

Gross domestic product (GDP) measures economic activity within a country and can be calculated in three ways: (i) as the sum of all production in the economy using gross value added (production approach); (ii) as the sum of all final expenditures in the economy (expenditure approach); and (iii) as the sum of all income in the economy, also using the gross value added, but decomposed into factor income (income approach). This third approach is the basis for the decomposition proposed in this report.

As illustrated in Figure A A.1., GDP (at market prices) is the sum of gross value-added (at basic prices) plus taxes minus subsidies on products. Gross value added is the sum of all output (at basic prices) minus intermediate consumption at purchaser's prices (i.e. the inputs used to produce all goods and services in the economy). This information is included in the OECD ICIO with value added (at basic prices) for each country and industry, as well as taxes minus subsidies on products.²¹

Using additional information from the national accounts used to build the OECD ICIO, gross value added can be further decomposed into labour compensation, taxes minus subsidies on production and gross operating surplus plus gross mixed income. The value added and its different capital components are gross in the sense that the depreciation of capital is not removed (as opposed to net value added, net operating surplus and net mixed income that account for the depreciation of capital). Labour compensation is broadly available but data on taxes minus subsidies on production are not always provided and gross mixed income is generally not separated from gross operating surplus. Some work is needed to properly identify income to capital, by reallocating some of the mixed income to labour compensation. Once capital income is estimated, the next step is to separate out income to tangible and intangible capital.

²⁰ See <http://oe.cd/tiva> for the list of industries and countries.

²¹ The concept of GDP is not fully reflected in the OECD ICIO as all values are in basic prices and only taxes minus subsidies on intermediate products are reported. What we decompose is (gross) value added plus taxes minus subsidies on products that are recorded in the ICIO.

Figure A A.1. Decomposition of gross domestic product

Gross value added breakdown into labour compensation and capital income

As illustrated in Figure A A.1., gross value added is broken down into the SNA components taxes minus subsidies on production, labour compensation and gross operating surplus plus gross mixed income, where the mixed income is composed of both income to labour and to capital. To properly estimate the share of gross value added going into labour compensation, the mixed income must be split into labour and capital.

Countries tend to use different methods to estimate the mixed income and data are not always comparable across economies. Pionnier and Guidetti (2015^[58]) recommend several types of adjustments to make them more comparable, including by imputing a labour compensation to self-employed workers at a disaggregated industry level. Moreover, mixed income tends to be under-estimated because of under-reporting. A recent ILO report shows that there is a substantive share of labour that is informal in agriculture sectors (ILO, 2019^[59]).

Cho, Hwang and Schreyer (2017^[53]) review the main methods used to estimate the share of labour income in the gross value added and to deal with the mixed income. A first set of methods are based on the collection of data on employment and self-employment and apply the compensation of employees to the self-employed. A parameter can be included in order to control for the lower income of the self-employed workers as compared to employees. A second set of methods consists in reallocating a fixed share of mixed income to labour compensation (a share of 2/3 to labour is often used in the literature). When data are available, one can start from the net mixed income as depreciation only concerns the capital part of the mixed income. But to follow this method, the mixed income must be available at country-sector level, which is not always the case. Given the fact that the compilation of mixed income is heterogeneous across countries, following (ILO, 2019^[59]) our favourite method is based on the collection of data on employment of self-employees. However, when not possible because of a lack of data, we reallocate a share of the mixed income to labour compensation (2/3 to labour and 1/3 to capital).

Table A A.1 indicates for each country the method that was used to adjust labour shares, while Figure A A.2 reports at the aggregate level the size of the adjustment for each country. On average, the adjustments made reallocate 7% of the share of gross value added to labour compensation.

Table A A.1. Sources for the adjustment of labour shares

Methodology	Countries
No reallocation (no data available)	Chinese Taipei.
Reallocation of a fixed share of mixed income (source: UNSD)	Brunei Darussalam; Cambodia; Hong Kong, China; Kazakhstan; Malaysia; Morocco; New Zealand; Peru; Philippines; Saudi Arabia; Singapore; Thailand; Tunisia; Viet Nam.
Reallocation based on data on self-employment (source: ILO)	Argentina; Chile; Colombia; Costa Rica; Iceland; Israel; South Africa.
Reallocation based on data on self-employment (source: WIOD)	Australia; Austria; Belgium; Brazil; Bulgaria; Canada; China; Croatia; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; India; Indonesia; Ireland; Italy; Japan; Korea; Latvia; Lithuania; Luxembourg; Malta; Mexico; Netherlands; Norway; Poland; Portugal; Romania; Russia; Slovak Republic; Slovenia; Spain; Sweden; Switzerland; Turkey; United Kingdom; United States.

Figure A A.2. Adjusted labour shares (2015)

Source: Authors' calculations based on the OECD ICIO, national accounts, ILO (2019) and WIOD.

Estimation of the stock of tangible capital and its remuneration

In national accounts, capital income is reported in the income accounts as gross operating surplus plus a share of gross mixed income. In order to disentangle returns to tangible capital from returns to intangible capital, we have to estimate the remuneration of tangible capital. The price of renting a capital service is generally expressed as $pK = q[r + \delta - \dot{q}/q]K$ where K is the stock of capital, δ the depreciation rate, r the rate of return, p the capital service price, q the price of investment and $\dot{q}/q$ the rate of capital gain (Jorgenson and Griliches, 1967^[60]). Assuming that the rate of capital gain is zero (i.e. the value of assets does not rise) as in Chen et al. (2017^[13]; 2018^[12]), the remuneration of capital is: $pK = q[r + \delta]K$. The only variables needed to estimate returns to capital are the price of new investment, capital stock, the internal rate of return and the depreciation rate.

Stocks of capital are primarily reported in balance sheets and are required to produce the accumulation account that records assets and liabilities in an economy (European Commission, IMF, OECD, United

Nations and World Bank, 2008^[61]). In the best case, stocks of capital are recorded by asset and by industry. We use the sources listed in Table A A.2 to collect information on capital stocks.

Table A A.2. Data sources for capital stocks

A. By country

Country	Source
Argentina	ARG
Australia	OECD
Austria	OECD
Belgium	ESTAT
Bulgaria	PWT
Brazil	PWT
Brunei Darussalam	PWT
Canada	OECD
Switzerland	Federal Statistical Office - Net non financial capital stock
Chile	KLEMS LA
China	PWT
Colombia	KLEMS LA
Costa Rica	PWT
Czech Republic	OECD
Germany	KLEMS EU
Denmark	OECD
Spain	KLEMS EU
Estonia	OECD
Finland	OECD
France	OECD
United Kingdom	ESTAT
Greece	OECD
Hong Kong, China	PWT
Croatia	PWT
Hungary	OECD
Indonesia	PWT
India	PWT
Ireland	OECD
Iceland	Statistics Iceland
Israel	OECD
Italy	OECD
Japan	OECD
Kazakhstan	PWT
Cambodia	PWT
Korea	OECD
Lithuania	OECD
Luxembourg	KLEMS EU
Latvia	KLEMS _{EU} , OECD
Morocco	PWT
Mexico	KLEMS LA
Malta	PWT
Malaysia	PWT
Netherlands	OECD
Norway	OECD
New Zealand	OECD

Peru	PWT
Philippines	PWT
Poland	ESTAT
Portugal	ESTAT, OECD
Romania	PWT
Russia	Federal State Statistics Service
Saudi Arabia	PWT
Singapore	PWT
Slovak Republic	ESTAT
Slovenia	ESTAT
Sweden	ESTAT, KLEMS _{EU}
Thailand	NESDC - Capital stock of Thailand
Tunisia	PWT
Turkey	PWT
Chinese Taipei	PWT
United States	OECD
Viet Nam	PWT
South Africa	PWT

B. Additional data sources

Name	Source
Eurostat	NAMA10NFAST
KLEMS EU	Capital inputs
KLEMS LA	Capital inputs
KLEMS WORLD	Capital files
OECD National Accounts	SNATABLE9A
Penn World Table	Capital detail
UNSD	Table 2.6

For many countries, data on capital are not available. While KLEMS and OECD report data at the most disaggregated level (by asset and by industry), data from other sources are often by asset or by industry. Industries can also be more aggregated than in the OECD ICIO. In this case, we split capital stocks based on the share of value added in the OECD ICIO. This is typically the case for the mining sector, which is split into three industries in the ICIO: D05T06 (energy), D07T08 (non-energy) and D09 (services).

For some countries, data are only available by asset for the total economy. In order to get data by industry, we regress (using a Poisson regression) the value of assets on fixed effects for asset class, industry, asset class x industry, asset class x income group.²² When values are missing, the predicted values from the model are used. Lastly, when the sum of values by industry are not equal to the country's total, the estimated values are reallocated proportionally to the share of value added in each industry so that their sum is equal to the total value.

Lastly, a RAS algorithm (Miller and Blair, 2009^[62]) is applied (changing the estimates only) so that the sum of the disaggregated values is equal to the values attributed to total assets and to total industries, which themselves are in line with the country total stock.

²² Groups of countries are created using percentiles of GDP per capita. We create three income groups for developed, emerging and developing countries.

Rates of return on tangible capital

In a paper discussing Lucas' paradox, Caselli and Feyrer (2007^[63]) calculate a set of rates of returns covering developing and developed countries. They discuss three ways to derive rates of returns on capital. The first is the cross-country comparison of interest rates, the second is through a regression of the variation of value added on the variation of capital and the last one is calibration. Their approach is to estimate the marginal product of capital MPK (which is equal to the rate of return on capital in perfectly competitive markets). MPK can be calculated with data on total income, capital stock and capital share in income. When compared across countries, they find that rates of return are equalised: the returns to investing on capital are not higher in developing countries than in developed countries. Interestingly, they point out that in traditional estimations of rates of returns, natural resources are not taken into account and lead to much higher rates of return for developing countries. More recently, using the same methodology as in Caselli and Feyrer (2007^[63]), David, Henriksen and Simonovska (2014^[64]) build a panel of rates of returns over 60 years, encompassing economies with different levels of income. They find different rates of returns between developing and developed economies. In the long term, developing economies have a higher rate of return on capital than developed economies; this corresponds to a risk premium for investing in developing countries. Inklaar, Woltjer and Albarran (2019^[65]) produce internal rates of return for the Penn World Tables (version 9.1). They estimate the stock of capital from data on investment. Then, using data on price indices and depreciation, they calculate the internal rates of return that sums up to the share of income in gross domestic product (with a correction to take into account rents on natural resources). They also find different internal rates of return across countries. While developed countries invest in short-lived assets, developing countries invest more in long-lived assets with different rates of returns.

Other papers investigating rates of return in developing countries find that returns may be significantly higher in small enterprises and the informal sector, but underdeveloped credit markets often restrict the access to capital to those firms (Hanson, 2010^[66]; McKenzie and Woodruff, 2008^[67]; Udry and Anagol, 2006^[68]). Reviewing further studies (mainly based on India), Banerjee and Duflo (2005^[69]) echo this finding and conclude that while overall rates of return may not be much higher than those of developed countries, there may be significant differences among economies.

In a study on the declining labour share in income in the United States, Barkai (2016^[70]) calculates a rate of return based on the cost of the debt and the cost of equity which is around 5% between 2005 and 2010 with a capital inflation of 2%. He also introduces differences in rates of returns across assets.

Based on Barkai (2016^[70]), we estimate the rate of return on tangible capital based on the cost of debt. We use data from the IMF on lending rates and from the World Development Indicators on inflation and calculate the real internal rate of return as the lending rate minus inflation rate for countries with available data. In order to take into account the different rates of return across countries, we estimate the average internal rate of return for three groups of economies based on their income per capita as in David et al. (2014^[64]) and Inklaar et al. (2019^[65]). We finally obtain three rates of returns: 3.6% for the most developed economies, 4.5% for middle-income economies and 5.6% for developing economies. Countries with missing information on the cost of debt are allocated to these groups based on their income per capita.

As a robustness check, we calculate the share of returns to capital in income in countries covered by TiVA (excluding the housing sector and public sector) with different rates of return. The tested rates include the Penn World Tables (version 9.1) estimates, a fixed rate of 4% across all countries as in Chen et al. (2017^[13]; 2018^[12]) and a 'naïve' rate of return equal to the marginal product of capital ($MPK_{naïve} = \alpha \cdot Y/K$ where α is the share of capital input in GDP, Y is gross domestic product and K is the capital stock).

To test whether our calculations are sensitive to the choice of the rate of return, we calculate the income of tangible capital using a series of alternative rates. Damodaran (2019^[71]) provides data on total market and industry-level cost of capital for a number of high-income countries and emerging markets, which we adjust for inflation to obtain the real rate of return. We further use rates computed in Penn World Tables

and own rates from naïve calculations (see above) based on TiVA data. At the world level and for covered countries, we do not find substantial differences and our estimations based on interest rates are in line with other internal rates of returns.

Figure A A.3. Estimation of returns to tangible capital using different rates of return

Billion USD, 2005-2015

Note: based on data for Australia, Austria, Belgium, Bulgaria, Canada, Chile, Colombia, Costa Rica, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Latvia, Lithuania, Malta, Mexico, the Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Romania, the Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Source: Authors' own calculations, Damodaran (2019), IMF lending rates and deflators from SNA, Penn World Tables and OECD TiVA.

Depreciation rates

We use the depreciation rates available in the EU KLEMS database which are the same across countries and years but differ between industries and assets. As for estimates based on the Penn World Tables, depreciation rates are based on BEA's calculations but with further refinements for cultivated assets and for R&D (Jäger, 2017^[72]).

The assumption that depreciation rates are the same across countries has been discussed by Görzig (2005^[73]) who finds differences in consumption of fixed capital across EU countries. Two major sources of discrepancies are highlighted. First, there is diversity regarding economic characteristics across countries, e.g. related to demography and geography, as well as economic specialisation and market structure. Second, there is heterogeneity with respect to statistical methodologies for compiling capital stocks.

Comparing available depreciation rates across assets (Evans (2003^[74]), Baldwin, Liu and Tanguay (2015^[75])), we find small differences for categories of assets. A recent report (EY, 2018^[76]) reviews the rates by asset reported by accountants in each country. It points out similar practices across countries with depreciation rates on building between 2% and 4%, on equipment and machinery between 10 and 20%, on computer and software around 30% and on R&D products around 40%, as in the EU KLEMS database.

Returns to intangible capital

Following the methodology developed by Chen et al. (2017^[13]; 2018^[12]), we calculate returns to intangible capital as the difference between gross value added and the remuneration of labour and tangible capital (plus taxes minus subsidies on production). But within this residual, we also account for the intellectual property assets reported in national accounts in SNA 2008 which are ‘research and development’, ‘mineral exploration and evaluation’, ‘computer software and databases’ and ‘entertainment, literary or artistic originals’. We apply a fixed rate of return of 4% for these intangible assets which is the rate applied by Chen et al. (2017^[13]; 2018^[12]) for tangible capital and is in line with rates found for overall capital in the literature (tangible plus intangible). Since intangible assets account for a higher share of returns to capital than tangible assets, the rate of return for intangible capital cannot depart too much from this average of 4%. However, there might be more variation across intangible assets and across countries for these intangible rates of returns. But the literature on rates of returns to intangible assets is scarce and we have not found any convincing study providing empirical evidence or methodologies that would suggest different rates. It should also be noted that the SNA intangible assets account for a small share on average of the gross value added, thus limiting the impact of our assumption on returns to SNA intangible assets.

With our methodology, we end up with two measures of returns to intangible assets. First, an ex-ante estimate for the returns to intangible assets reported in SNA (‘measured intangible capital’) and then a residual which corresponds to ‘unmeasured intangible capital’ and captures a broader set of intangible assets, such as brands or organisational capital. As previously emphasised, this residual can also capture assets or firm-specific characteristics of firms that have created value but are less related to intangible capital in the sense of innovation and knowledge, such as rents related to market power derived from government interventions rather than market imperfections related to technology. Our methodology cannot disentangle such determinants of value added. But since we account for SNA intangible assets, we have at least a share of returns to intangible capital which is unambiguously related to intangible investment.

At the industry level, estimated returns to capital (tangible assets plus SNA intangible assets) can be higher than the income to capital reported by the country in its national accounts (i.e. the gross operating surplus plus a share of gross mixed income). When it happens, we consider the reported income to capital as an upper limit and proportionally reallocate this value to tangible capital and SNA intangible capital with the unmeasured intangible capital (residual) becoming zero. This concerns a small but non-negligible number of observations in the dataset (less than 20%).

Returns related to natural resources

Another refinement we introduce in the methodology of Chen et al. (2017^[13]; 2018^[12]) is an estimation of rents related to natural resources. Since non-produced assets are not accounted for in national accounts, part of the residual in gross value added that we interpret as intangible capital includes returns for the exploitation of natural resources that create value added without a corresponding investment (leaving aside the investment in the physical and intangible capital corresponding to the extraction and production of these natural resources which is accounted for). As a consequence, countries rich in natural resources tend to have a high residual that we should not interpret only as returns to intangible capital. Therefore, we make the following adjustment to remove from the ‘unmeasured intangible capital (residual)’ a component related to natural resources. We rely on estimates provided by the World Bank (2011^[77]) on rents on natural resources (expressed as a share of GDP) by year and by country for different types of natural resources. We map these natural resources to TiVA industries as shown in Table A A.3.

Table A A.3. Mapping of natural resources to TiVA industries

Natural resources categories from World Bank (2011)	TiVA industries
Coal rents (% of GDP)	D07T08 - Mining (non-energy)
Forest rents (% of GDP)	D01T03 - Agriculture
Mineral rents (% of GDP)	D07T08 - Mining (non-energy)
Natural gas rents (% of GDP)	D05T06 - Energy
Oil rents (% of GDP)	D19 - Coke and Petroleum

Factor income along the value chain

Each GVC in the analysis is defined based on the industry of final production. For final production, the value added reported in the ICIO is decomposed according to the above described methodology. In order to look at value added upstream in the value chain, we use the ‘Leontief inverse’, which is a matrix indicating for each dollar of final output how much output is needed in each country and industry (including in all upstream stages of production). By multiplying the value-added shares in each industry by the Leontief inverse and by a vector of final demand, we can obtain a value-added decomposition of final demand (as available in the TiVA database). The shares of income of labour, tangible capital, intangible capital (measured and residual) and taxes minus subsidies in each country and industry are then applied to this value-added matrix to decompose final demand into factor income. The difference between the final stage and this decomposition provides figures for factor income in upstream stages.²³

For the distribution stage, we use the information from the underlying ICIO data when purchasers’ prices are converted into basic prices. Trade margins (as well as transport margins and taxes) are estimated by product and industry in this process and we can obtain a value for trade margins in each industry. This information however reflects only domestic margins as the supply table as a different column for imports. Trade margins are brought back to the industry of final production and their value-added is decomposed using the input-output information from the distribution sector (wholesale and retail trade) and the returns to labour, intangible and intangible capital previously calculated for this sector. As opposed to Chen et al. (2017^[13]; 2018^[12]), we do not have a full international supply-use table with the output by product in purchaser’s prices but we can retrieve the information on trade margins by product and recalculate the corresponding trade margins by industry to work with the final demand in basic prices plus trade margins for each industry.

²³ For a formal exposition and more details on these calculations, see Chen et al. (2017^[13]; 2018^[12]). We follow the same methodology except that we further decompose intangible capital into ‘measured intangible capital (SNA)’ and ‘unmeasured intangible capital (residual)’.

Annex B. Additional regression results

This part of the report presents additional results supporting the empirical exploration of policies explaining returns to intangible capital presented in Section 5. Table A B.1 and Table A B.2 present the main findings presented in Table 5.1 and Table 5.2 but also report the coefficients of the control variables.

As natural resource rents might affect the estimates of returns to unmeasured intangible capital, this annex also presents additional results focused on this aspect. Table A B.3 and Table A B.4 present results of regressions excluding the five sectors with the highest share of inputs sourced from natural resource sectors (with the latter being defined as agriculture, mining of energy-producing products, mining of non-energy producing products, mining support services, as well as coke and refined petroleum products).²⁴ Table A B.5 and Table A B.6 instead report regressions that control for a sector's input and output links (with the controls varying by sector, country and year) to natural resource sectors.

Given their weightless character as assets devoid of any physical embodiment, intangibles facilitate efforts of MNEs to minimize their tax burden. Table A B.7 and Table A B.8 report robustness checks (corresponding to Table 5.1 and Table 5.2) that exclude a set of nine countries highlighted in the literature on corporate strategies and tax policies.

The methodology (described in Section 2.4 as well as in Annex A) requires the selection of an *ex-ante* rate of return on tangible capital. This part of the report therefore also presents regressions based on alternative choices regarding this *ex ante* rate of return on tangible capital. The results shown in Table A B.9 and Table A B.10 were obtained using country-specific rates of returns on tangible capital reported in the Penn World Table.²⁵ In addition, Table A B.11 and Table A B.12 display the regression results obtained when using industry-level rates of return on tangible capital based on Damodaran (2019_[71]).²⁶

As the methodology adopted for this report also involves the selection of an *ex ante* rate of return on intangible capital covered in the SNA, this section also includes tables showing the results of regressions using alternative rate of returns on measured intangible capital. Following Li and Hall (2018_[78]), the use of a rate of return on measured intangible capital of 9% was explored (see Table A B.13 and Table A B.14).²⁷

Regarding mark-ups (Section 5.3), Table A B.15 shows the results of regressions that include, in addition to all variables included in the regressions reported in Table 5.3, also a control for the effectiveness of a country's antimonopoly policy.

With respect to the discussion of the role of IPR protection and enforcement (Section 5.2), Table A B.16 displays results of regressions linking returns to intangible capital to three measures of industry-level IPR intensity.

²⁴ Similar results (not reported) were obtained based on regressions that exclude the five sectors with the highest share of output sold to those natural resource sectors.

²⁵ We also obtained similar results (not reported) when adopting the approach chosen by Chen et al. (2017_[13]; 2018_[12]), i.e. using an *ex ante* rate of return of 4% for all countries, industries and years.

²⁶ Note that an approach allowing the rate of return on tangible capital to vary by country and industry could not be explored due to the insufficient availability of information on rates of return on tangible capital by industry and country.

²⁷ Drawing inspiration from Ugur et al. (2016_[82]), a rate of 14% was also tested and the overall picture remained similar (results not reported).

Table A B.1. Economic openness (including coefficients of controls)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.005 (0.003)				0.010** (0.004)			
Unweighted tariff (all manufacturing)		-0.014*** (0.005)				0.012* (0.007)		
STRI			-33.999*** (7.774)				-15.492** (6.509)	
FDI restrictiveness				-21.597*** (6.091)				-23.139*** (7.044)
Corporate income tax rate	-0.007*** (0.003)	-0.008*** (0.003)	0.038*** (0.005)	-0.010** (0.004)	0.003 (0.003)	0.002 (0.003)	0.050*** (0.008)	-0.007 (0.006)
Effectiveness of antimonopoly policy	0.051*** (0.017)	0.055*** (0.018)	0.087 (0.059)	0.034 (0.026)	-0.101*** (0.026)	-0.091*** (0.027)	0.184 (0.122)	-0.009 (0.036)
Natural resource rents (% GDP)	-0.011*** (0.003)	-0.013*** (0.003)	-0.019 (0.025)	-0.002 (0.004)	-0.009*** (0.003)	-0.012*** (0.004)	0.073** (0.037)	-0.004 (0.007)
Shadow economy (% GDP)	-0.048*** (0.005)	-0.048*** (0.005)	-0.153*** (0.023)	-0.046*** (0.007)	-0.078*** (0.008)	-0.078*** (0.009)	-0.014 (0.034)	-0.041*** (0.011)
Observations	6,157	5,956	1,233	3,358	6,157	5,956	1,233	3,358
R-squared	0.249	0.248	0.266	0.087	0.175	0.176	0.177	0.075
Country-industry combinations	788	788	620	685	788	788	620	685

Note: Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects. A constant is included but not reported.

Table A B.2. Innovation policies (including coefficients of controls)

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.322*** (0.057)			0.135 (0.099)		
Government funding of business R&D (share of GDP)		1.376*** (0.203)			1.861*** (0.397)	
Quality of IPR protection (higher=stronger protection)			0.033** (0.017)			-0.073** (0.030)
Corporate income tax rate	-0.012*** (0.003)	-0.013*** (0.003)	-0.004 (0.003)	-0.001 (0.004)	0.002 (0.004)	0.000 (0.004)
Effectiveness of antimonopoly policy	0.068*** (0.021)	0.002 (0.022)		-0.191*** (0.031)	-0.215*** (0.030)	
Natural resource rents (% GDP)	-0.006 (0.006)	-0.012* (0.006)	-0.008** (0.003)	-0.001 (0.008)	-0.001 (0.008)	-0.002 (0.003)
Shadow economy (% GDP)	-0.049*** (0.006)	-0.060*** (0.006)	-0.048*** (0.004)	-0.085*** (0.011)	-0.097*** (0.009)	-0.065*** (0.008)
Observations	4,630	4,319	5,348	4,630	4,319	5,348
R-squared	0.200	0.194	0.239	0.176	0.194	0.189
Country-industry combinations	595	636	783	595	636	783

Note: Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects. A constant is included but not reported.

Table A B.3. Economic openness (excluding sectors dependent on natural resource inputs)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.006 (0.005)				0.017** (0.008)			
Unweighted tariff (all manufacturing)		-0.019*** (0.006)				0.012 (0.009)		
STRI			-36.838*** (10.524)				-11.731 (8.374)	
FDI restrictiveness				-19.698** (8.050)				-30.825*** (11.311)
Observations	4,132	3,996	828	2,251	4,132	3,996	828	2,251
R-squared	0.244	0.244	0.257	0.079	0.177	0.178	0.154	0.073
Country-industry combinations	526	526	416	457	526	526	416	457

Note: This table reports the results of regressions based on a sample that excludes the following five sectors: food products, wood products, chemicals, non-metallic mineral products, basic metals. Those five sectors display – among all the manufacturing sectors included in the TiVa database – on average (cross all years and countries included in the database created for this paper) the highest dependence on natural resources in terms of the share of total intermediate consumption sourced from a set of five natural resource sectors (agriculture, mining of energy-producing products, mining of non-energy producing products, mining support services, as well as coke and refined petroleum products). Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.4. Innovation policies (excluding sectors dependent on natural resource inputs)

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.351*** (0.071)			0.078 (0.126)		
Government funding of business R&D (share of GDP)		1.744*** (0.276)			2.059*** (0.533)	
Quality of IPR protection (higher=stronger protection)			0.049** (0.022)			-0.078* (0.040)
Observations	3,105	2,900	3,596	3,105	2,900	3,596
R-squared	0.201	0.207	0.241	0.179	0.194	0.193
Country-industry combinations	397	424	522	397	424	522

Note: This table reports the results of regressions based on a sample that excludes the following five sectors: food products, wood products, chemicals, non-metallic mineral products, basic metals. Those five sectors display – among all the manufacturing sectors included in the TiVa database – on average (cross all years and countries included in the database created for this paper) the highest dependence on natural resources in terms of the share of total intermediate consumption sourced from a set of five natural resource sectors (agriculture, mining of energy-producing products, mining of non-energy producing products, mining support services, as well as coke and refined petroleum products). Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.5. Economic openness (controlling for linkages to natural resource sectors)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.005 (0.003)				0.012*** (0.004)			
Unweighted tariff (all manufacturing)		-0.013** (0.005)				0.015** (0.007)		
STRI			-35.583*** (7.798)				-16.057** (6.494)	
FDI restrictiveness				-24.977*** (6.428)				- 31.646*** (8.473)
Share of inputs sourced from natural resource sectors	0.250 (0.186)	0.202 (0.196)	0.325 (0.317)	0.668*** (0.182)	0.833*** (0.289)	0.768** (0.307)	0.480 (0.338)	0.333 (0.236)
Share of output sold to natural resource sector	-1.386*** (0.365)	-1.440*** (0.365)	-2.639*** (0.948)	-1.918*** (0.485)	-1.712*** (0.532)	-1.891*** (0.516)	-1.071 (1.300)	-0.465 (0.566)
Observations	6,157	5,956	1,233	3,358	6,157	5,956	1,233	3,358
R-squared	0.254	0.252	0.280	0.102	0.179	0.179	0.168	0.079
Country-industry combinations	788	788	620	685	788	788	620	685

Note: This table reports the results of regression controlling for a sector's dependence on natural resources in terms of the share of total output sold to a set of five natural resource sectors (agriculture, mining of energy-producing products, mining of non-energy producing products, mining support services, as well as coke and refined petroleum products) and the share of inputs sourced from those five sectors. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.6. Innovation policies (controlling for linkages to natural resource sectors)

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.320*** (0.056)			0.107 (0.096)		
Government funding of business R&D (share of GDP)		1.426*** (0.206)			1.908*** (0.393)	
Quality of IPR protection (higher=stronger protection)			0.030* (0.017)			-0.081*** (0.031)
Share of inputs sourced from natural Resource sectors	0.132 (0.256)	0.325 (0.300)	0.265 (0.172)	0.994** (0.390)	1.382*** (0.488)	0.485** (0.207)
Share of output sold to natural resource sector	-1.204** (0.533)	-0.865 (0.541)	-1.064*** (0.337)	-1.172 (0.825)	-1.046 (0.810)	-0.629 (0.425)
Observations	4,630	4,319	5,348	4,630	4,319	5,348
R-squared	0.202	0.197	0.241	0.178	0.199	0.184
Country-industry combinations	595	636	783	595	636	783

Note: This table reports the results of regression controlling for a sector's dependence on natural resources in terms of the share of total output sold to a set of five natural resource sectors (agriculture, mining of energy-producing products, mining of non-energy producing products, mining support services, as well as coke and refined petroleum products) and the share of inputs sourced from those five sectors. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.7. Economic openness (excluding countries highlighted in tax literature)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.007** (0.003)				0.010** (0.004)			
Unweighted tariff (all manufacturing)		-0.020*** (0.005)				0.012 (0.007)		
STRI			-5.454* (3.047)				-20.832*** (6.378)	
FDI restrictiveness				-23.082*** (5.920)				-22.822*** (7.156)
Observations	5,233	5,032	1,089	3,002	5,233	5,032	1,089	3,002
R-squared	0.270	0.273	0.485	0.120	0.186	0.187	0.190	0.070
Country-industry combinations	671	671	548	613	671	671	548	613

Note: This table reports regressions based on a sample that excludes observations referring to Belgium, Hong Kong (China), Ireland, Luxembourg, Malta, Netherlands, Singapore or Switzerland. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.8. Innovation policies (excluding countries highlighted in tax literature)

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.350*** (0.056)			0.171* (0.102)		
Government funding of business R&D (share of GDP)		1.284*** (0.203)			1.930*** (0.404)	
Quality of IPR protection (higher=stronger protection)			0.050*** (0.018)			-0.079** (0.031)
Observations	4,062	3,824	4,545	4,062	3,824	4,545
R-squared	0.233	0.221	0.269	0.183	0.203	0.196
Country-industry combinations	523	549	666	523	549	666

Note: This table reports regressions based on a sample that excludes observations referring to Belgium, Hong Kong (China), Ireland, Luxembourg, Malta, Netherlands, Singapore, or Switzerland. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects, industry-year fixed effects and three controls (corporate income tax rate, natural resource rents, shadow economy). In addition, columns 1, 2, 4 and 5 also control for antimonopoly regulation. The constant is not reported.

Table A B.9. Economic openness (using country-specific rate of return on tangible capital)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.008*** (0.003)				0.012* (0.007)			
Unweighted tariff (all manufacturing)		-0.021*** (0.005)				0.028*** (0.010)		
STRI			-35.822*** (7.993)				-15.297 (10.699)	
FDI restrictiveness				-21.709*** (5.795)				-65.953*** (22.816)
Observations	6,276	6,066	1,245	3,406	6,276	6,066	1,245	3,406
R-squared	0.262	0.263	0.261	0.092	0.084	0.084	0.058	0.064
Country-industry combinations	793	793	625	688	793	793	625	688

Note: This table presents the results of a robustness check based on the use of time-varying country-specific rates of return on tangible capital taken from the Penn World Table. After adjusting for inflation, the average across all years and countries included in the dataset is 5.9%. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.10. Innovation policies (using country-specific rate of return on tangible capital)

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.153*** (0.056)			-0.183 (0.162)		
Government funding of business R&D (share of GDP)		0.896*** (0.168)			3.103*** (0.993)	
Quality of IPR protection (higher=stronger protection)			0.048*** (0.016)			-0.263*** (0.063)
Observations	4,701	4,395	5,481	4,701	4,395	5,481
R-squared	0.202	0.191	0.246	0.111	0.118	0.078
Country-industry combinations	598	639	789	598	639	789

Note: This table presents the results of a robustness check based on the use of time-varying country-specific rates of return on tangible capital taken from the Penn World Table. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects, industry-year fixed effects and three controls (corporate income tax rate, natural resource rents, shadow economy). In addition, columns 1, 2, 4 and 5 also control for antimonopoly regulation. The constant is not reported.

Table A B.11. Economic openness (using industry-level rate of return on tangible capital)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.008*** (0.003)				0.006 (0.004)			
Unweighted tariff (all manufacturing)		-0.020*** (0.005)				0.010 (0.007)		
STRI			-35.380*** (7.864)				-21.195*** (5.909)	
FDI restrictiveness				-21.633*** (5.756)				-44.262*** (11.835)
Observations	6,275	6,065	1,245	3,405	6,275	6,065	1,245	3,405
R-squared	0.263	0.264	0.265	0.092	0.146	0.148	0.162	0.087
Country-industry combinations	793	793	625	688	793	793	625	688

Note: This table presents the results of regressions based on the use rates of return on tangible capital that are specific to groups of industries and are based on Damodaran (2019[71]). Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.12. Innovation policies (using industry-level rate of return on tangible capital)

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.155*** (0.054)			0.130 (0.095)		
Government funding of business R&D (share of GDP)		0.848*** (0.161)			2.221*** (0.314)	
Quality of IPR protection (higher=stronger protection)			0.044*** (0.015)			-0.047 (0.034)
Observations	4,700	4,394	5,481	4,700	4,394	5,481
R-squared	0.203	0.191	0.247	0.151	0.164	0.152
Country-industry combinations	598	639	789	598	639	789

Note: This table presents the results of regressions based on the use rates of return on tangible capital that are specific to groups of industries and are based on Damodaran (2019^[71]). Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.13. Economic openness (using 9% as rate of return on SNA intangibles)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Measured intangible capital				Unmeasured intangible capital			
Unweighted tariff (industry)	-0.004 (0.003)				0.011*** (0.004)			
Unweighted tariff (all manufacturing)		-0.014** (0.005)				0.013** (0.007)		
STRI			-33.840*** (7.720)				-13.006* (6.799)	
FDI restrictiveness				-22.588*** (6.287)				-30.811*** (8.686)
Observations	6,184	5,983	1,237	3,370	6,184	5,983	1,237	3,370
R-squared	0.243	0.241	0.258	0.090	0.163	0.164	0.158	0.077
Country-industry combinations	789	789	621	686	789	789	621	686

Note: This table presents the results of a robustness check based on the use of a fixed return of 9% on intangible capital recorded in the SNA for all countries. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects and industry-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). A constant is included but not reported.

Table A B.14. Innovation policies (using 9% as rate of return on SNA intangibles)

	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital			Unmeasured intangible capital		
Tax subsidy for SMEs	0.317*** (0.058)			0.107 (0.097)		
Government funding of business R&D (share of GDP)		1.512*** (0.217)			1.777*** (0.401)	
Quality of IPR protection (higher=stronger protection)			0.037** (0.017)			-0.068** (0.033)
Observations	4,651	4,334	5,380	4,651	4,334	5,380
R-squared	0.198	0.194	0.236	0.167	0.184	0.173
Country-industry combinations	596	637	784	596	637	784

Note: This table presents the results of a robustness check based on the use of a fixed return of 9% on intangible capital recorded in the SNA for all countries. Standard errors clustered at country-industry level. All regressions include country-industry fixed effects, industry-year fixed effects and three controls (corporate income tax rate, natural resource rents, shadow economy). In addition, columns 1, 2, 4 and 5 also control for antimonopoly regulation. The constant is not reported.

Table A B.15. Returns to intangible capital and mark-ups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Overall	Intermediate	Final	Distribution	Overall	Intermediate	Final	Distribution
	Measured intangible capital				Unmeasured intangible capital			
Lagged logarithm of mark-up gap	-0.010 (0.016)	-0.008 (0.014)	-0.023 (0.019)	0.010 (0.009)	0.012 (0.015)	0.006 (0.011)	0.060 (0.053)	0.036* (0.019)
Effectiveness of antimonopoly policy	-0.008 (0.030)	-0.012 (0.029)	-0.014 (0.041)	-0.072*** (0.022)	-0.272*** (0.049)	-0.178*** (0.039)	-0.581*** (0.167)	-0.307*** (0.076)
Observations	2,242	2,242	2,242	2,242	2,242	2,242	2,242	2,242
R-squared	0.312	0.261	0.264	0.305	0.270	0.349	0.164	0.168
Country-industry combinations	302	302	302	302	302	302	302	302

Note: The mark-up gap was calculated as the mark-up at the 90th percentile (of the mark-up distribution in a given country and industry) minus the mark-up at the 10th percentile. Standard errors clustered at country-industry level. All regressions also include country-industry fixed effects, industry-year fixed effects and three additional controls (corporate income tax rate, natural resource rents, shadow economy). A constant is included but not reported.

Data on the usage of different IPRs is unfortunately not available at the level of aggregation (by country, industry and year) of the dataset created for this report. Yet, industry-level information provided by the European Patent Office and the European Union Intellectual Property Office allows for a set of exploratory regressions linking three measures of IPR intensity to returns to intangible capital (EUIPO and EPO, 2016^[79])²⁸ presents the results of regression exploring the association between our estimates of returns to two types of intangible capital and the extent of an industry's usage of patents (columns 1 and 2), trademarks (columns 3 and 4) and designs (columns 5 and 6). As the variables referring to IPR intensity only vary across industries, these regressions only include country-by-year fixed effects and should be considered as purely descriptive. Overall, these regressions show a strong positive link between IPR intensity and returns to intangible capital. With the exception of the link between design intensity and returns to unmeasured intangible capital (column 6), this relationship is statistically significant (columns 1-5).

Table A B.16. Intellectual property right intensity

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Measured intangible capital	Unmeasured intangible capital	Measured intangible capital	Unmeasured intangible capital	Measured intangible capital	Unmeasured intangible capital
Logarithm of patents per 1,000 employees	0.386*** (0.039)	0.171*** (0.044)				
Logarithm of trademarks per 1,000 employees			1.548*** (0.089)	1.575*** (0.085)		
Logarithm of designs per 1,000 employees					0.214*** (0.080)	0.123 (0.094)
Constant	-6.080 (10.601)	-8.922 (12.801)	-8.299 (10.369)	-11.227 (12.517)	-6.258 (10.548)	-9.035 (12.775)
Observations	6,157	6,157	6,157	6,157	6,157	6,157
R-squared	0.684	0.615	0.749	0.725	0.641	0.607

Note: All regressions include country-year fixed effects as well as all controls (corporate income tax rate, natural resource rents, shadow economy, antimonopoly regulation). Standard errors clustered at country-industry level. A constant is included but not reported.

²⁸ The authors of this report are grateful to researchers at the European Union Intellectual Property Office (EUIPO) and the European Patent Office (EPO) for providing access to the industry-level IPR intensity data created for a joint EUIPO-EPO publication (EUIPO and EPO, 2016^[79]).