THE ECONOMIC CONTRIBUTION OF TRADEMARK-INTENSIVE INDUSTRIES

In Indonesia, Malaysia, the Philippines, Singapore, and Thailand

Report prepared for the International Trademark Association

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CONTENTS

EXECUTIVE SUMMARY

The purpose of this study is to assess the economic contribution of trademark-intensive industries in 5 economies in the ASEAN region: Indonesia, Malaysia, the Philippines, Thailand and Singapore, which between them account for nearly 90% of the ASEAN community's combined GDP.[1] We define trademark-intensive industries as those industries that have an above average use of trademarks per employee. This approach builds, notably, on the work carried out by the EUIPO/EPO in the context of the European Union.[2] We chose this methodology as a starting point since, like this study, the EUIPO/ EPO worked across multiple countries.

We assess the economic contribution of trademark-intensive industries using two methods:

■ We use economic census and survey data of business activities, as well as national accounts data prepared by national statistics authorities and international sources, to compute direct and indirect contributions of trademark-intensive activities. The direct contributions are defined, for example, in terms of the employment, output and value added generated by any particular trademark-intensive industry.[3] Indirect contributions reflect the fact that there are interdependencies, through the purchase and sale of inputs, between trademark and non-trademark-intensive industries. For example, agriculture, a major sector in 4 of the 5 economies considered, is not trademark-intensive in and of itself, but does depend significantly on the purchase of inputs from trademark-intensive industries.

■ We use an econometric methodology to estimate whether value added per worker changes when one moves from a non-trademark-intensive to a trademark-intensive industry. We can call this the "trademark effect". The reason for doing this is that whereas the calculation of the direct and indirect effects described above helps to map the existing economic and social "footprint" of trademark-intensive industries, it does not answer the question of how much extra value may be generated if more of a country's economic resources are allocated to trademark-intensive industries.

Direct and indirect effects

Trademark-intensive activities play a significant role in the economies of Indonesia, Malaysia, the Philippines, Thailand and Singapore.

Summary table 1 provides an overview of key performance indicators for trademark-intensive activities in the five countries covered by this report.

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[11] Calculations based on World Bank data (World Development Indicators) for 2016, at constant 2010 US dollars.

[2] European Union Intellectual Property Office/ European Patent Office (2016), *Intellectual property rights intensive industries and economic performance in the European Union*.

[3] "Value added" for any industry refers to the value of output (i.e. quantities multiplied by producer prices), minus the value of intermediate inputs that are consumed in the production of the output.

Table 1 Trademark-intensive industries – key performance indicators[4]

	Direct contribution to GDP	Indirect contribution to GDP	Employment	Share of exports
Thailand	22%	40%	13%	60%
Malaysia	30.3%	60%	24%	55%
Philippines	17%	41%	15%	47%
Indonesia	21%	51%	26%	27%
Singapore	50%	55%	29%	60%

Source: Frontier Economics calculations based on national survey data, national accounts data, and World
Bank and OECD sources. Employment figures for Indonesia refer to manufacturing only

The direct contribution of trademark-intensive industries to GDP varies between around a fifth and a third of GDP; Singapore is an outlier. (The figure for the Philippines is likely an understatement because of the way in which data are presented in national accounts). When linkages are taken into account, in order to measure indirect contributions, the overall contribution of trademark-intensive industries increases. In four of the five economies considered, this is primarily because of the significant links to agriculture and extractive industries. Again, Singapore is an outlier because it does not have significant primary industries.

In all of the five economies, manufacturing is the dominant force in trademark-intensive activities. Though in the case of Singapore, this dominance is less pronounced, with trademark-intensive services (notably wholesale and retail services) accounting for close to the same share of overall value added (22% versus 26% for manufacturing).

In four of the five economies (Indonesia being the exception), computer, electronics and related equipment constitute the main industry within manufacturing. This is, in part at least, a reflection of patterns of specialisation in international trade, and specifically the role of these countries within the cross-border value chains that have come to be such a prominent feature of computer and electronics manufacturing. In Indonesia, food products are the main trademark-intensive manufacturing category.

In four of the five economies, we also observe a strong export orientation on the part of trademark-intensive activities, which in Malaysia, Singapore and Thailand directly or indirectly account for the majority of exports by value, and close to half the value of exports in the Philippines. This is consistent with the prominent role played by industries, such as computer and electronic manufacturing, which are heavily integrated into international supply chains. Food and beverage sectors, which play a relatively greater role in Indonesia, by contrast, tend to more oriented towards domestic markets; indeed, part of the rationale for brands to establish production facilities in a location is to adapt to local market tastes.

Measuring the share of trademark-intensive industries in total employment is complicated by data availability concerning the informal sector, especially in

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[4] The order in which we present the countries in this table reflects the order in which they are discussed in the report. We begin with Thailand because of the richness of the data available, which makes it a suitable country to demonstrate the methodology that is then applied to the other four countries, subject to data availability.

Thailand, Philippines, and Indonesia. If we take into account, available data on informal activities, notably in agriculture, we note that employment shares vary considerably across countries, and to some extent in line with overall development. In the more developed countries, employment in trademark-intensive-industries accounts for a higher share of overall employment, which is consistent with the fact that the informal sectors, notably in agriculture, are relatively smaller.

Econometric analysis

The econometric analysis suggests that for the set of countries as a whole, the effect of trademark-intensiveness on value added per worker ("the trademark effect") is strongly positive and significant. We find that, as an upper bound, the "trademark effect" increases value added per worker by around 90%. Since trademark protection is strongly correlated with patent protection (notably), we can try and filter out the effects of patents to identify the effects of trademarks alone. Our modelling suggests an effect of around 57%, which can be interpreted as the lower bound for the contribution of trademark-intensiveness to value added.

The strong and positive effects are reflected in four of the five countries studied. They make intuitive sense when we consider the sectors that are most trademark-intensive tend to be more export-oriented, which tends to increase productivity per worker. By contrast, if we consider non-trademark-intensive industries, we find that there are significant primary industries or non-tradable services in which productivity tends to be lower.

The only country in which we do not find a statistically significant "trademark effect" is Indonesia. This does *not* mean that trademark-intensive industries do not contribute to the Indonesian economy. Rather it means that their contribution is not statistically different to that of other industries.

The result for Indonesia could reflect issues of data availability. It could also reflect the structure of Indonesian manufacturing, which is more dominated by food and beverages, than sectors such as computers and electronics which have experience rapid growth through international value chains. Certain particular aspects of the Indonesian economy – such as a legacy of extensive government ownership and a lower degree of trade openness – may be compounding factors. Finally, the result may also point to the need to further strengthen the enforcement of trademark protection. For example, weaknesses in trademark, and IPR, enforcement generally, tends to reduce incentives to invest, which would have a direct bearing on productivity. If that is the case, the difference between Indonesia and the others could also be interpreted as the payoff available to Indonesia should it be able to implement a higher level of trademark enforcement.

More generally, from a policy perspective, the findings suggest that greater trademark-intensiveness is associated with a transition toward higher-value added activities that are linked to global supply chains. The development of such export oriented strategies is an important part of the development strategies for the region as a whole. The findings of the report therefore suggest that trademark protection, and IPR protection more generally, carries its weight as part of a wider enabling policy framework geared to strengthening the conditions for private sector investment and production in the region.

1 INTRODUCTION

1.1 Objectives of the study

The purpose of intellectual property rights (IPRs) is to ensure that innovators enjoy appropriate returns to their investments, while also ensuring that society as a whole benefits from the use of products and services resulting from these innovations. Optimal IPR policy requires balancing these concerns. From the perspective of economic growth and development, an important focus has been the contribution made by IPR protection to growth via investment.[5]

A trademark is a form of intellectual property right. It is a sign that makes it possible to distinguish the goods and services provided by one firm from those of another. Businesses invest in trademarks, and more broadly in product branding, as part of their competitive strategy. In particular, trademarks enable businesses to convey to consumers various product attributes and product quality. They can therefore help markets function more efficiently since consumers are able to make more informed choices than they would have been able to in the absence of trademarks. Viewed from this perspective, trademarks help businesses to appropriate investments they make in product quality and reputation.

The economic contribution of trademarks specifically, as distinct from other forms of IP, has been less well examined. The purpose of this study is to measure the economic contribution of industries that make an intensive use of trademarks ("trademark-intensive industries") to five economies in the ASEAN region: Indonesia, Malaysia, the Philippines, Singapore and Thailand. Together, these countries account for close to 90% of combined GDP for the ASEAN community.

Our approach to this question builds on and adapts recent work done on IP-intensive industries in other parts of the world. Most notably, we draw on the methodology used by the EUIPO/EPO in its study on IP-intensive industries, including trademark-intensive industries, in Europe.[6] We follow this approach as it deals with multiple jurisdictions, as is the case with our study.

The EUIPO/EPO methodology consisted of the following steps:

1. Retrieving information on IPRs (trademarks, for the purpose of this study) from databases linked to registers.

2. Mapping IPR information to firm-level data.

3. Defining thresholds for identifying IP-intensive businesses and industries, based on collecting data on aggregates of interest (output, employment etc) and mapping these to industry classifications. The study calculated trademark-intensity on the basis of the number of trademarks per employee. Businesses

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[5] See for example, David Gould and William Gruben, (1996) "The role of intellectual property rights in economic growth", Journal of Development Economics, Vo. 48.2

[6] Notably, EUIPO (2016), Intellectual Property Rights Intensive Industries and Economic Performance in the European Union; U.S. Economics and Statistics Administration and U.S. Patent and Trademark Office (2012) Intellectual Property and the U.S. Economy: Industries in Focus.

that had an above-average number of trademarks per employee were considered to be trademark-intensive.

4. Deriving estimates of economic contribution and performance by measuring the share of IP-intensive industries relative to all activities, typically by drawing on National Accounts data and other sources of macroeconomic data (e.g. wage data). The methodology also allows to measure indirect impacts, by consulting Input-Output (I-O) tables to identify upstream and downstream industries that are connected to the IP-intensive industries through the supply of inputs or purchase of outputs.

Steps 1-2 represent the "front-end" of the analysis. Steps 3- 4 are the "back-end" of the analysis that is used to derive overall economic impacts. To the extent the data availability permits it, we have followed these steps for the purposes of the study.

Because of certain limitations regarding the availability of trademark registration data for all 5 of the selected countries constrained our ability to undertake steps 1 and 2, we have adapted the EUIPO/EPO approach.[7] We have used as a starting point the list of trademark-intensive industries used in their study. We then have matched these with country-specific information on industry performance and overall economic data to construct performance indicators. Following this, we developed threshold levels of trademark intensity that, when applied to the national accounts for these countries, allow us to measure the direct and indirect contribution of trademark-intensives activities.

Our report is structured as follows:

- Section 2 presents our methodology and results for the five countries of interest;

- Section 3 presents an econometric analysis of the relationship between trademark-intensiveness and performance metrics for the five countries; and

- Section 4 presents summary observations and some policy implications.

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[7] We are grateful to the authorities of, respectively, the Philippines, Singapore and Thailand for providing access to trademark registration data.
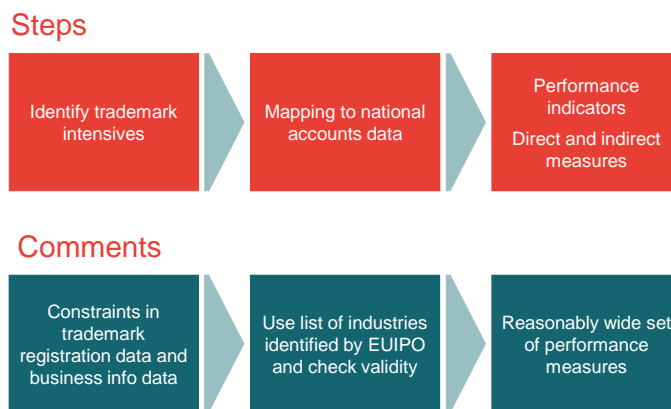
2 METHODOLOGY AND FINDINGS

2.1 Overview of methodology

Figure 1 summarises the methodology employed to measure direct and indirect contributions.

Figure 1.   Overview of approach to date

Approach to date

Steps

| Identify trademark intensives | Mapping to national accounts data | Performance indicators Direct and indirect measures |

Comments

| Constraints in trademark registration data and business info data | Use list of industries identified by EUIPO and check validity | Reasonably wide set of performance measures |

4   **Frontier Economics**

The recent EUIPO/EPO study on the economic performance of IP-intensive industries contains a list of trademark-intensive industries.[8] We use this as a starting point and map the industries in this classification to the classification system used by the respective countries. The underlying assumption is that the identity of trademark-intensive industries remains broadly constant across countries, though their importance relative to each other and relative to the economy as a whole will vary across economies.[9]

A rough test of the validity of this assumption can be made by drawing on trademark registration data for Singapore and the Philippines (two countries for which we received registration data at an early stage in the project), and examining whether the industry classes that have a high concentration of trademarks are the same in both countries. The results in Figure 2 show there is a strong correlation between industry classes, across both countries, in terms of how they rank by trademark intensity.

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[8] EUIPO/EPO *Intellectual Property Rights-Intensive Industries and Economic Performance in the European Union*, pp132-136. The EUIPO/EPO study identifies 501 industries that use trademarks, of which 277 are trade mark-intensive, i.e. have an average number of trade mark classes per 1000 employees that exceeds the overall average of 3.16. A recent study commissioned by INTA and the Inter-American Association n of Intellectual Property used a similar approach, defining trademark intensity on the basis of two indicators: trademarks per employee and trademarks per unit of sales.

[9] The same assumption is made in the EUIPO study.

Figure 2.   Ranking of IP-intensive industries in Singapore versus Philippines
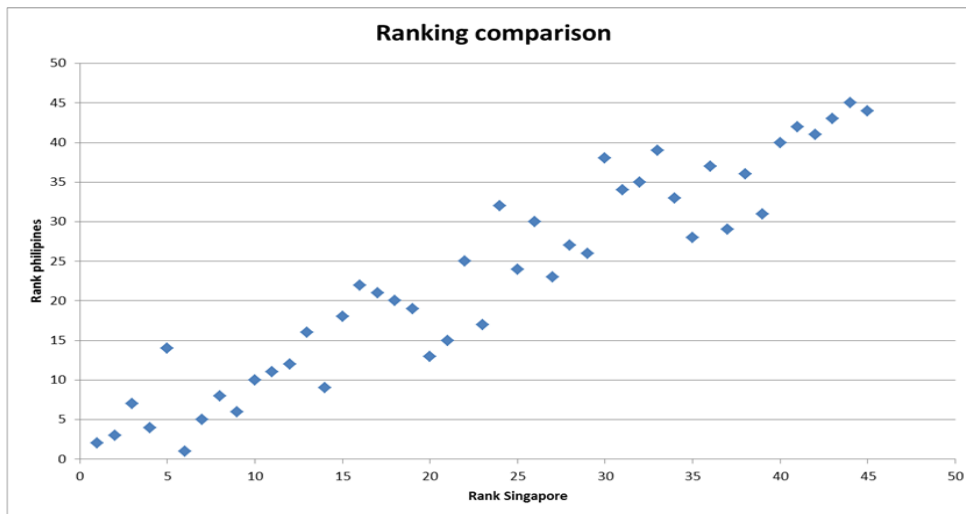
Once the mapping has been achieved, the next step is to construct indicators that measure the different dimensions of the trademark-intensive sectors contribution to the economy in question.

We differentiate between the direct and indirect contributions of trademark-intensive sectors. The *direct contributions* are those measured by performance indicators of the trademark-intensive businesses in and of themselves, such as number of businesses, contribution to overall and sector GDP, number of workers employed, wages paid, and so forth.

Indirect contributions reflect the fact the inter-linkages between sectors in an economy. That is, like any sector, trademark-intensive sectors will purchase and sell goods to other sectors. To take an example, agricultural activities in Thailand are not trademark-intensive in and of themselves. But they do depend on inputs from trademark-intensive sectors to a significant degree. These linkages need to be measured in order to capture the true contribution of trademark-intensive industries.

2.2 Thailand

2.2.1 Direct contributions[10]

Trademark-intensive industries accounted for around 22% of GDP.[11] Three sectors account for the bulk of this contribution: manufacturing (14%), wholesale and retail (5%), and real estate (2%). These figures do not account for indirect contributions

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[10]   Our principal source of firm-level data is The National Statistics Office (NSO), "The 2012 Business and Industrial Census" For more detail see here: http://web.nso.go.th/en/census/bi/bi12.htm

[11]   This estimate is likely to be slightly conservative because it excludes 44 TM intensive industries out of the 277 in the EUIPO classification. These industries could not be mapped to the classification system used by Thailand. In some cases this may be because the industries are not present in Thailand but in other cases the industries may be present but data are unavailable.

via linkages to other sectors that are not in and of themselves trademark-intensive. These are contributions are discussed in section [2.2.2].

Figure 3 presents various metrics that capture the contribution of trademark-intensive sectors as a whole in comparison to all sectors in the Thai economy, excluding agriculture and informal activities.[12] A comparison of the number of businesses (first bar) with the other indicators with the others suggests that trademark-intensive businesses in Thailand contribute disproportionately to employment, wages and social security. An analysis of remuneration data (Figure 4) suggests that trademark-intensive industries pay a premium of around 20% over non-trademark-intensive industries (or roughly 400 US Dollars per year).

Figure 3.   Trademark-intensive sectors relative to all sectors
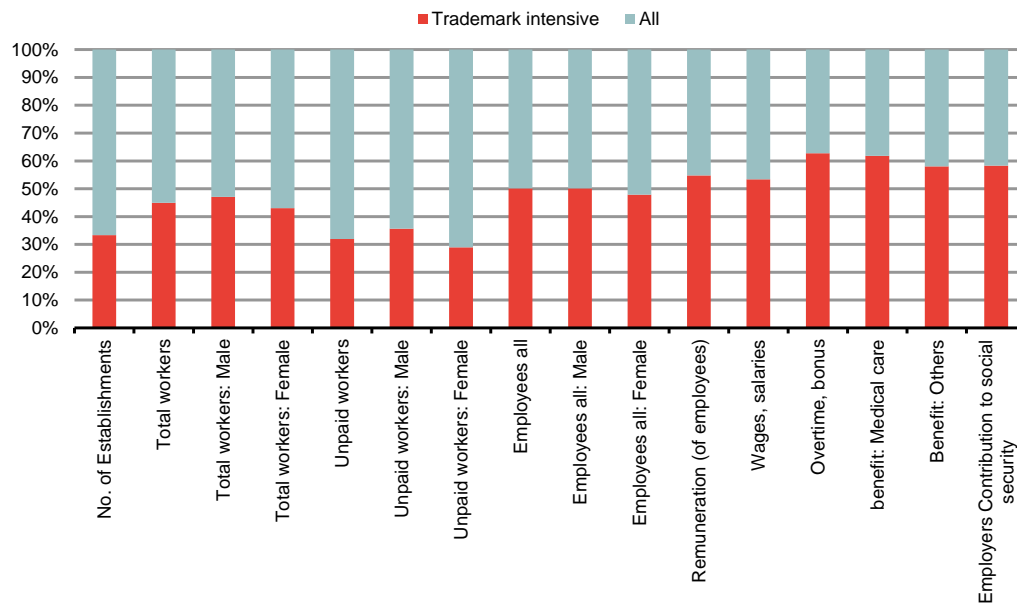
*Source: Frontier Economics calculations based on NSO business census data
            (http://web.nso.go.th/en/census/bi/bi12.htm)*

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[12] Because of uncertainties in the measurement of employment and labour-force data in informal activities and agriculture we focus on the formal sector in the first instance.

**Figure 4.** **Measures of social contribution, in Bahts.**
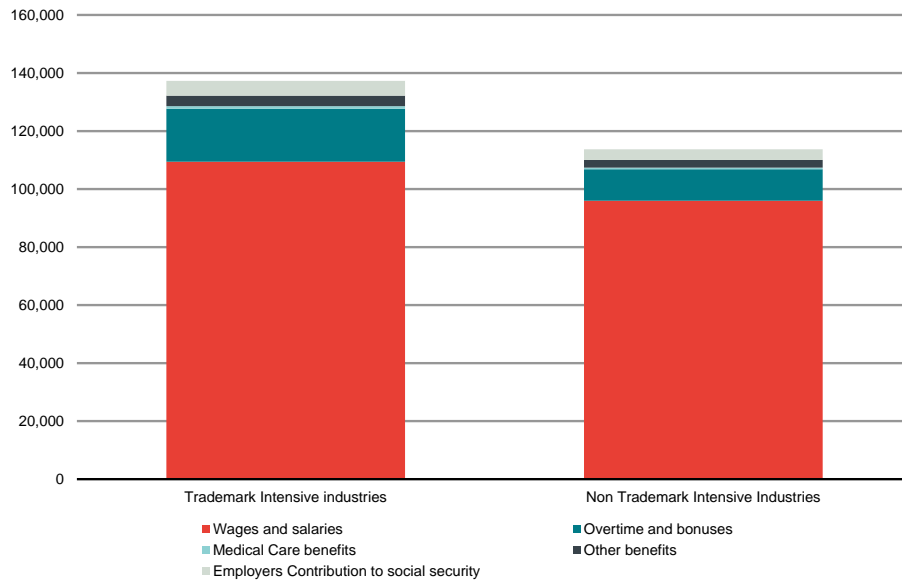
Source: Frontier Economics calculations based on NSO business census data
(http://web.nso.go.th/en/census/bi/bi12.htm)

If we use overall employment data, including data for informal activities, notably in agriculture, overall employment in trademark-intensive industries is around 13% of all employment.[13]

Figure 5 reports performance indicators for the three sectors for which trademark-intensive industries contribute most to overall GDP. By "contribution to sector GDP", we mean the share of trademark-intensive activities of a particular sector (e.g. the proportion of manufacturing sector GDP accounted for by trademark-intensive activities).

[13] Based on World Bank and Bloomberg data

Figure 5.   Manufacturing, Wholesale and retail trade and real estate
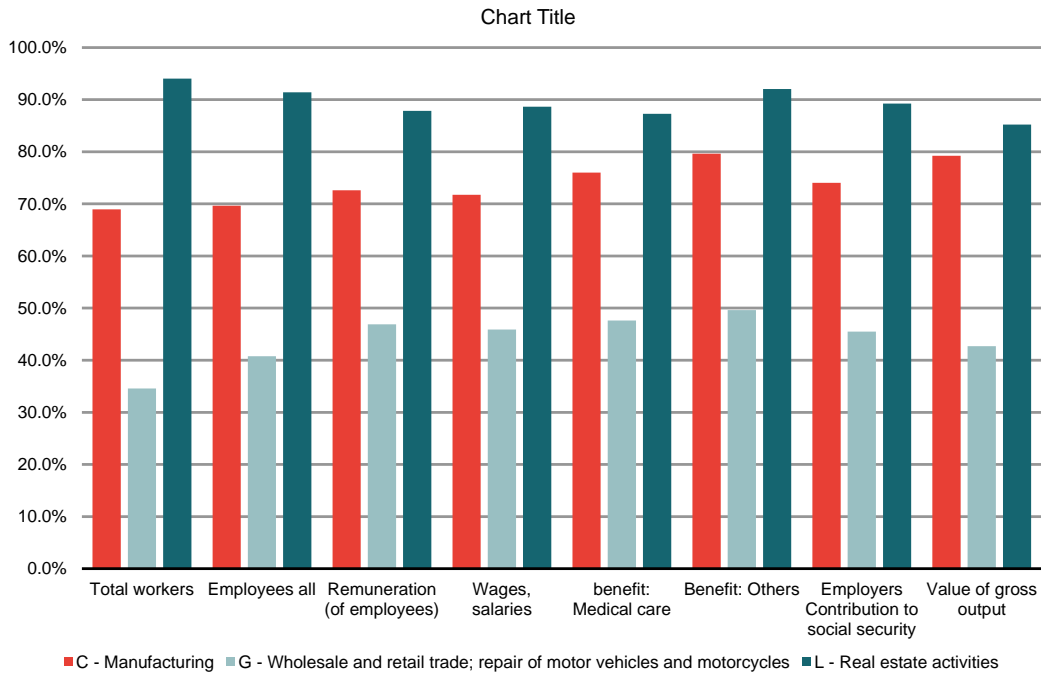
Source: *Frontier calculations based on NSO business census data*
           (http://web.nso.go.th/en/census/bi/bi12.htm)

As already observed, there are a number of sectors that, even though they may be small relative to the economy as a whole, are nevertheless highly trademark-intensive. Performance measures for these are reported in figure 6.
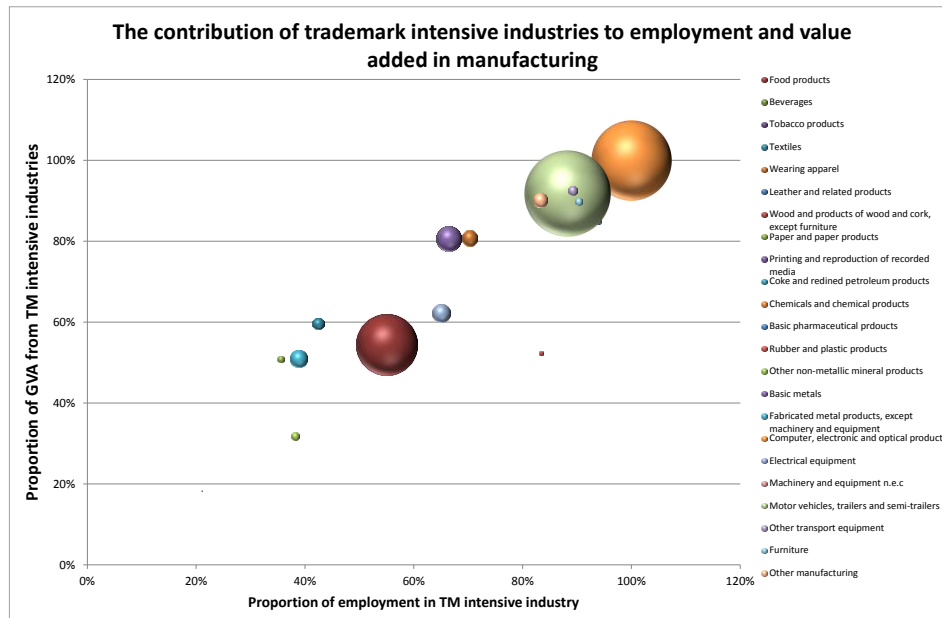
Figure 6.   Other trademark-intensive sectors
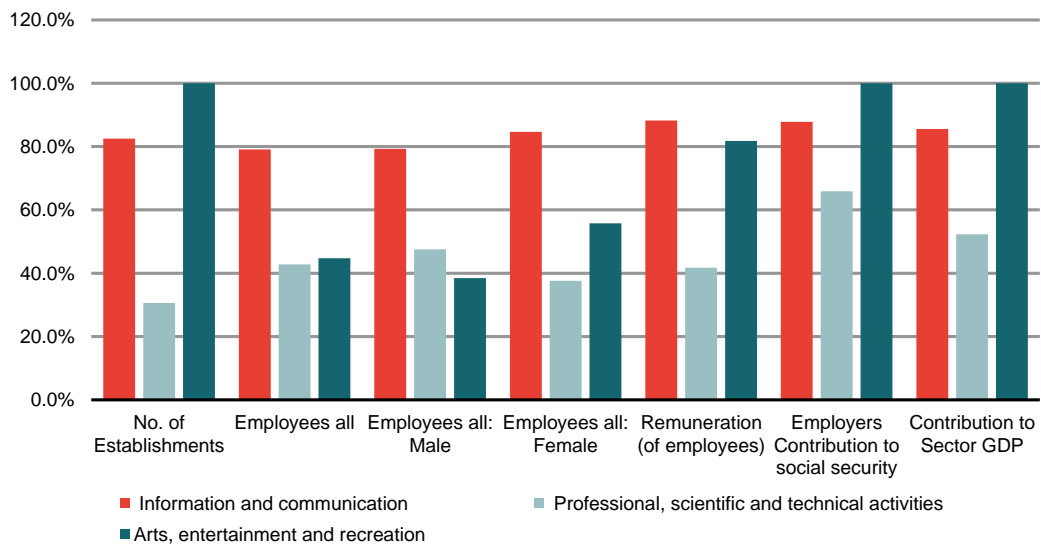
Source: *Frontier Economics calculations based on NSO business census data*
           (http://web.nso.go.th/en/census/bi/bi12.htm)

Given the size of the manufacturing sector relative to GDP, and also the importance accorded to the sector by policymakers in Thailand as an engine of economic growth, it is useful to develop a more fine-grained analysis of the trademark –intensive sub-sectors within manufacturing sectors. These are represented in Figure 7.

Figure 7.   Closer look at manufacturing – Thailand

The size of the bubbles depicts the magnitude of each sub-sector in terms of the value of their output. The horizontal, axis shows the share of employment accounted for by trademark-intensive activities in these subsectors, and the vertical axis the share of gross value added (GVA) accounted for by trademark-intensive activities. We observe, for example, that computer and electronic products are very trademark-intensive by both measures (close to 100% of value added and employment are accounted for by trademark-intensive businesses) and significant in terms of overall value.

2.2.2 Indirect effects

Indirect effects capture the inter-linkages between different sectors of an economy. It is important to capture these inter-linkages because, even if a sector is not in itself trademark-intensive, it may be closely linked to a trademark- intensive sector through sales and/ or purchases. In Figure 8, for example, we note that food products exhibit a relatively strong degree of trademark-intensiveness. One of the principal providers of inputs into this sector is agriculture, which is not itself trademark-intensive.

In order to flesh out the interdependencies, we have used an input-output table for Thailand.[14] An input-output table is essentially a matrix in which columns and rows

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[14]   Prepared by the National Statistics Office

represent particular sectors of the economy and their purchases and sales to every sector of the economy (including itself).

The input-output table presents information at a higher level of aggregation than the national accounts data we have been using to identify trademark-intensive sectors. We need to use the information at a lower level of aggregation to determine which of the sectors at the higher level are trademark- intensive. For example, if sector X in the input output table comprises of 4 subsectors, of which 2 are trademark-intensive should sector X itself be considered to be a trademark-intensive industry?

In order to answer that question, we use the following threshold: if 95% or more of a sector's value added is accounted for by trademark-intensive industries, then we classify it as "trademark-intensive". If the share is 75% or more, we classify it as medium-trademark-intensive. The thresholds are intended to be conservative (i.e. strict in terms of what can be classified as trademark-intensive).

Figure 8.   Indirect contribution of trademark-intensive activities by sector
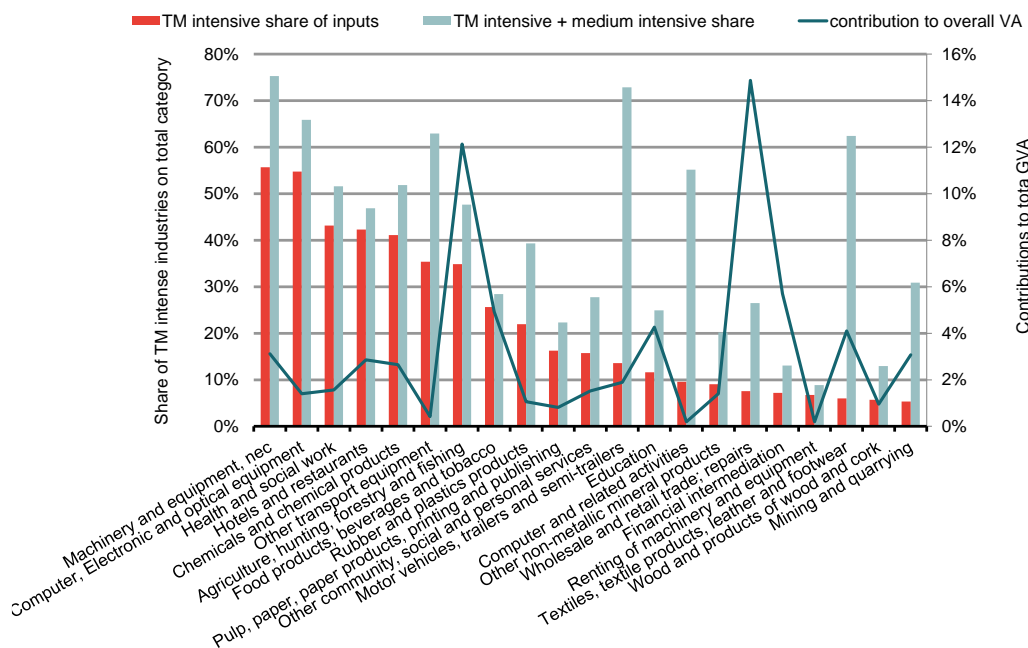
Source: Frontier Economics calculations based on NSO input-output tables

The red bars report the share of value added in any sector that is accounted for by inputs from trademark-intensive activities (whether from the sector itself or other sectors). The teal bars report the share accounted for by trademark-intensive and moderately trademark-intensive sectors. The line represents the contribution of the sector to overall gross value added (this should be read off against the scale on the right hand side).[15]

Sectors that are themselves trademark-intensive tend also consume a large proportion of inputs from trademark-intensive sectors. But we also note that there are sectors that are not in and of themselves trademark-intensive whose value

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[15]   Gross value added is GDP plus the value of subsidies minus the value of taxes

added relies to a significant extent (around 50%) on inputs from trademark-intensive industries. Examples include agriculture, hotels and restaurants, and health and social work. The reliance may reflect a particular reliance in these sectors on certain product attributes (e.g. durability or reliability in the case of agriculture and health, attractiveness in the hospitality sectors) that are conveyed by branding.

Once we take into account the indirect contributions of trademark-intensive industries through these interdependencies, the contribution of trademark-intensive industries increases to around 40% of GDP.

Input-output tables can be used to assess other dimensions of trademark-intensive. For example, on the basis of the definition of trademark-intensive sectors used above, and taking into account indirect contributions through sector linkages, we observe that these sectors account for around 60% of exports.

2.3 Malaysia

2.3.1 Direct contributions[16]

The direct contribution of trademark-intensive industries was measured at 30.3% of Malaysia's GDP.[17] The majority of that contribution is from the manufacturing sector, the contribution of which on its own is around 17% of GDP. Wholesale and retail (just over 5%) and information and communication (just under 5%) are the next largest other contributors.

Figure 9 presents various metrics measuring aspects of the industry's contributions to the Malaysian economy. A comparison of the proportion of businesses that are trademark-intensive with other metrics show that these businesses punch significantly above their weight.

An analysis of remuneration data suggests a premium of around 12% paid to workers by trademark-intensive industries.

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[16] The main source for firm-level data is the Economic Census (2011) prepared by the Department of Statistics of the Malaysia (DOSM).
https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=R0NCYkVUbVhCbmZwV2U0a3dTM29UZz09

[17] As was the case for Thailand this excludes some TM intensive industries (in this case 28 out 277) partly due to data limitations.

Figure 9.   Trademark-intensive sectors relative to all sectors
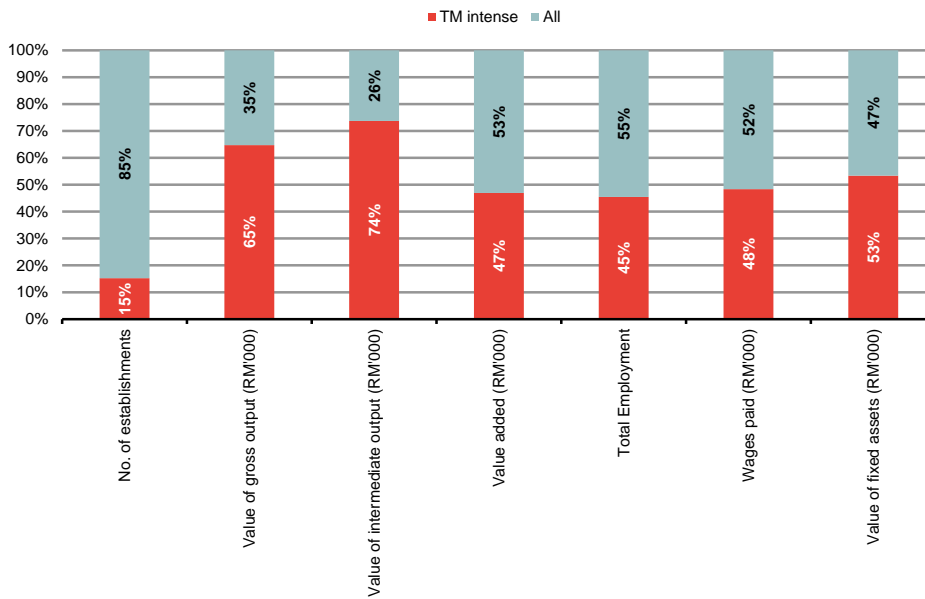
We also present a break-down of key metrics for the three main trademark-intensive sectors (Figure 10). The results bring out, notably, the strong performance of trademark-intensive activities in the manufacturing sector. The majority of businesses in this sector are trademark-intensive – the share is 4 times the amount for the economy as a whole. Even allowing for that larger share, trademark-intensive manufacturing businesses still make a disproportionately large contribution.

As in Thailand, total employment figures relate to formal sector data gathered through industry surveys. Once informal sector activities are taken into account, the share of overall employment accounted for by trademark-intensive industries is around 24%.

Figure 10.   Performance of three most trademark-intensive sectors

Contributions of TM intensive industries within three selected sectors
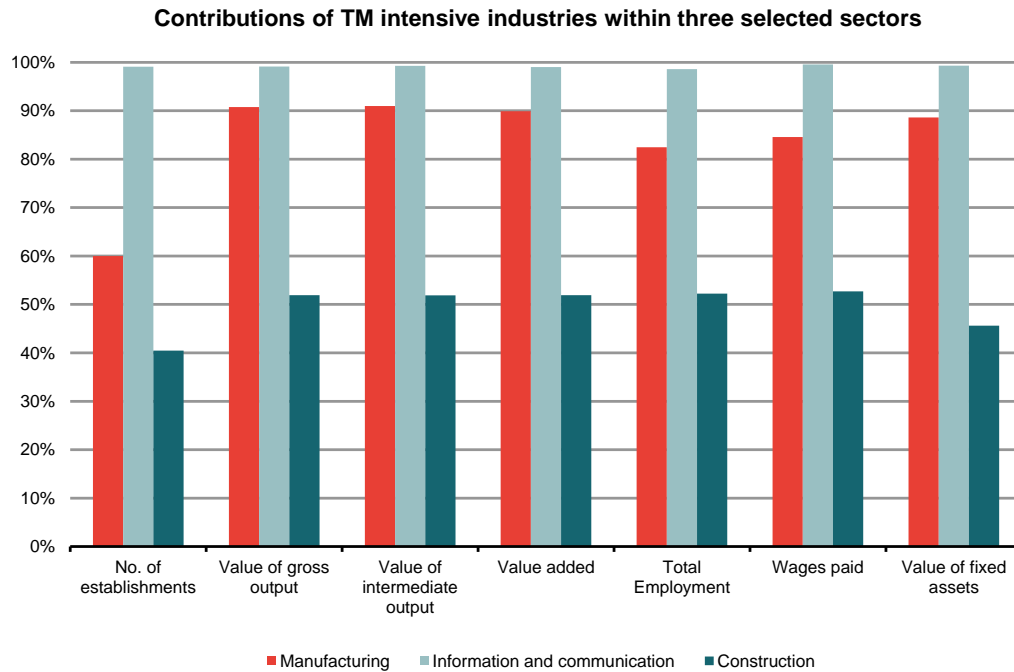
Source: Frontier Economics calculations based DOSM Economic Census data

As with other economies covered in this report, there are sectors that may be small in terms of their overall economic contribution, but which nevertheless are heavily influenced by trademark-intensive activities (Figure 11).

Figure 11.   Performance of three most trademark-intensive sectors

Contributions of TM intensive industries within selected sectors
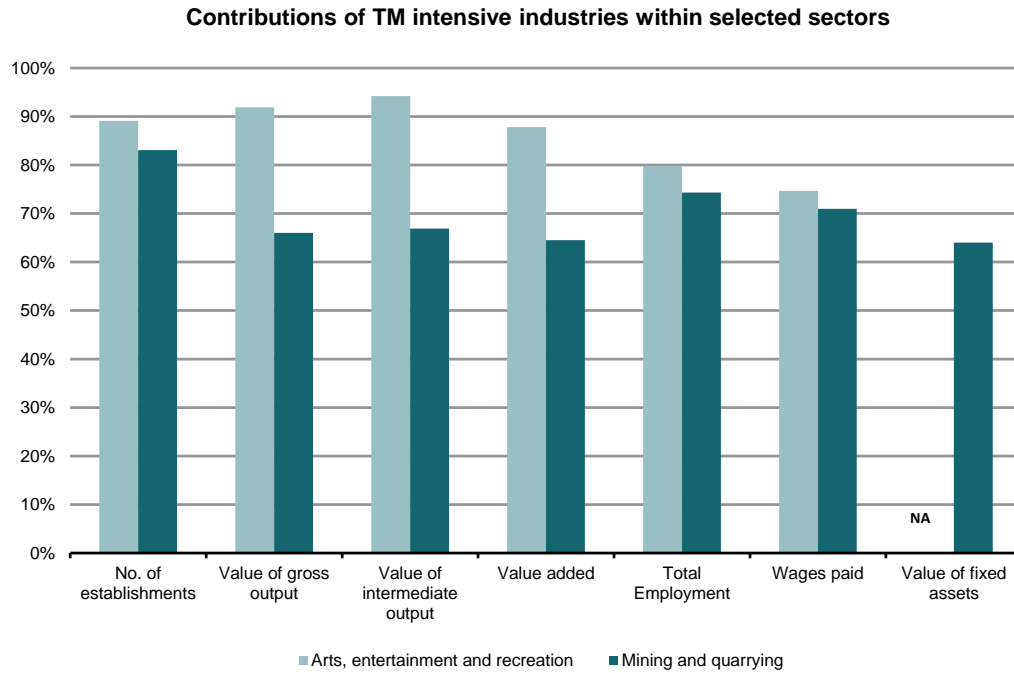
Source: Frontier Economics calculations based DOSM Economic Census data

Given the significant role played by trade-intensive manufacturing, it is opportune to present more detailed information on the types of activities within manufacturing and their economic contribution (Figure 12).

Figure 12.   Closer look at manufacturing - Malaysia
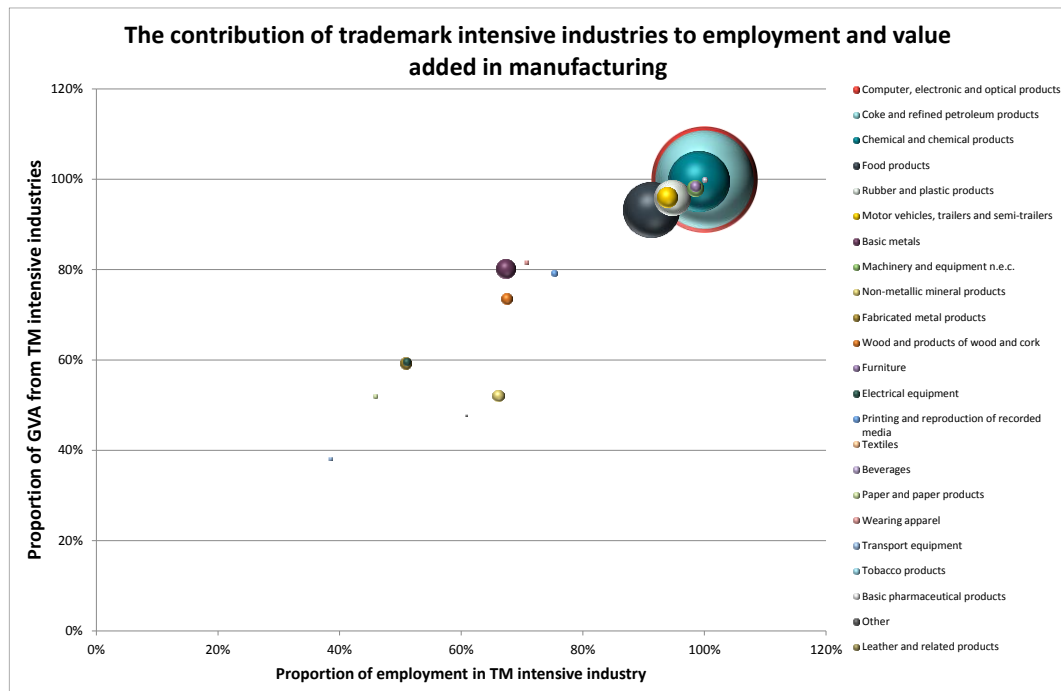
The contribution of trademark intensive industries to employment and value added in manufacturing

Source: Frontier Economics calculations based DOSM Economic Census data

The size of the bubbles depicts the magnitude of each sub-sector in terms of the value of their output. The horizontal, axis shows the share of employment accounted for by trademark-intensive activities in these subsectors, and the vertical axis the share of gross value added accounted for by trademark-intensive activities.

The chart reveals that computer, electronics and optical products, and coke and refined petroleum products dominate trademark-intensive manufacturing. These activities as a whole are significant export industries. Fuels account for around 20% of exports by value, and electrical and office machinery for around another 34%. Food products and chemical products are less significant but nevertheless strongly trademark-intensive.

2.3.2   Indirect effects

We follow the methodology presented in section 2.2.2 to derive estimates of indirect contributions of trademark-intensive industries to Malaysia.[18] Figure 13 illustrates the point, already made in section 2.2.2, that trademark-intensive industries contribute through their interdependencies with other sectors. Agriculture stands out as a sector that, while not trademark-intensive in and of itself, has strong linkages with trademark-intensive industries. Mining and quarrying activities have obvious linkages to trademark-intensive sectors such as petroleum, is also an important contributor to overall value added.

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[18]   We use the DOSM input-output tables (2011).

Figure 13.   Indirect contribution of trademark-intensive activities by sector
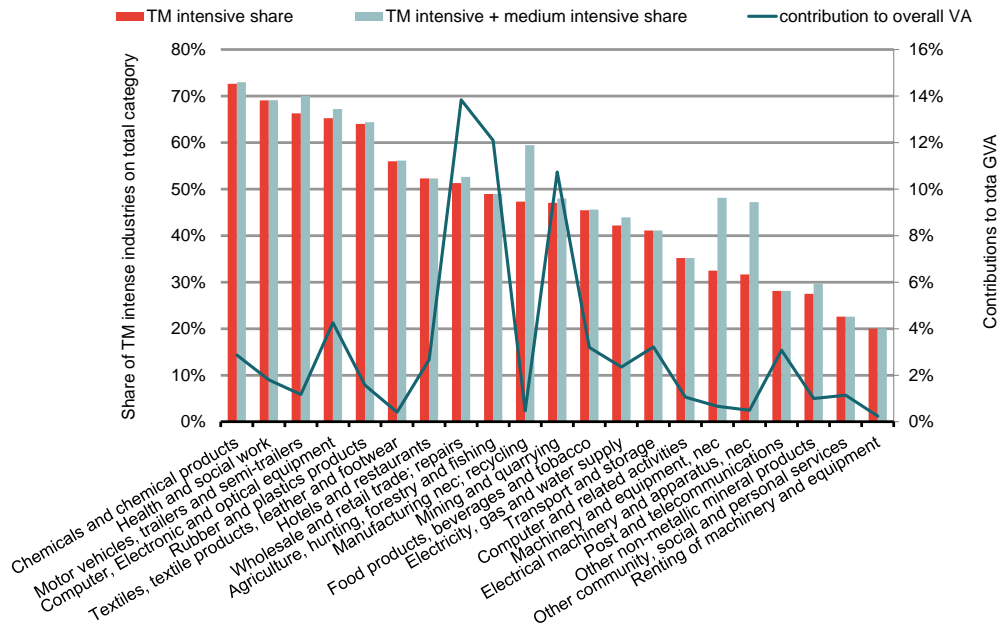
Once we take into account the extent of these interdependencies, the indirect contribution of trademark-intensive industries is around 60% of Malaysia's GDP. Trademark-intensive industries account for around 55% of total exports.

2.4 The Philippines

2.4.1 Direct contributions[19]

Trademark-intensive industries in the Philippines appear to be smaller than in the other jurisdictions covered in this study.[20] The direct contribution of trademark-intensive industries in the Philippines was estimated at a little over 17% of GDP.

Notwithstanding that, Figure 14 shows that trademark-intensive industries in the Philippines display some similarities to their counterparts elsewhere in the ASEAN region, in that the contribution of trademark-intensive businesses are disproportionately large relative to their numbers.

An analysis of remuneration data suggests that trademark-intensive industries pay a wage premium of around 30% over non-trademark-intensive industries. Note that

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[19] Source: 2012 Census of Philippine Business and Industry (CPEI). Covers all Businesses classified under the three broad industry groups namely: Agriculture, Industry and Services. The 2012 CPBI is one of the designated statistical activities of the former National Statistics Office (NSO) now Philippine Statistics Authority (PSA).

[20]   We believe that this could be partly be due to the way in which data are presented for the Philippines: the level of disaggregation is less fine-grained than it is for the other countries. This could mean that some trademark-intensive industries that in the Philippines only make up part of a particular sector code might be excluded, whereas in others they would have been included.

employment data in the figure below relates to formal sector activities covered by surveys. Based on available data for all economic activities, we estimate that trademark-intensive industries account for roughly 15% of overall employment.

Figure 14.   Trademark-intensive sectors relative to all sectors

Legend: ■ Trademark intensive ■ All

Category	Trademark intensive	All
No. of establishments	23%	77%
Total employees	32%	68%
Paid employees	32%	68%
Total Income	50%	50%
Total expenses	51%	49%
Total compensation	38%	62%
Other expenses	52%	48%
Gross output	65%	35%
Intermediate expense	70%	30%
Value added	44%	56%
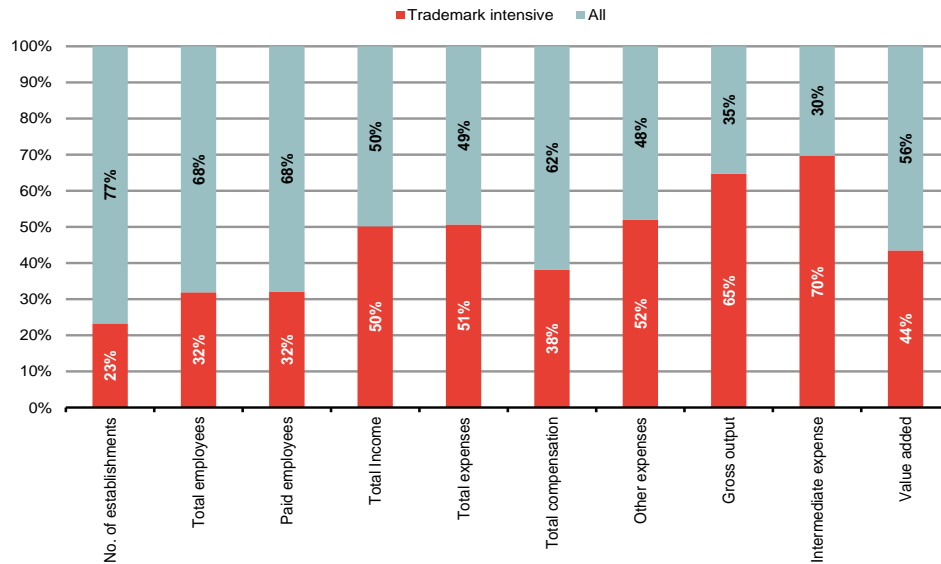
Source: Frontier Economics based on CPBI/ PSA data

The three most trademark-intensive industries in the Philippines are manufacturing, information and communication, and construction. Trademark-intensive manufacturing accounts for 10% of GDP, information and communications around 4% of GDP and construction around 3% of GDP.

Figure 15.   Trademark-intensive sectors relative to all sectors

Contributions of TM intensive industries within three selected sectors
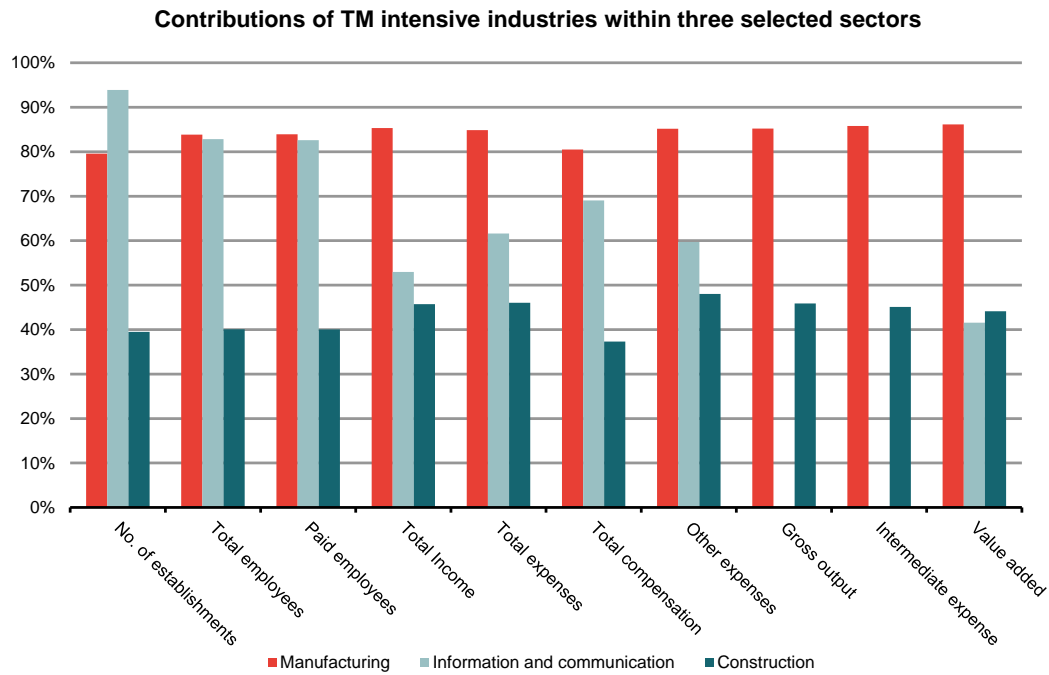
Source: Frontier Economics based on CPBI/ PSA data

A closer investigation into the manufacturing sector reveals the dominant role played by computer, electronic and optical products (Figure 16, top panel). These activities have been important historically for the Philippines, and are its top export earner, and (along with remittances) one of its primary sources of foreign exchange.

The sheer size of the computer, electronic and optical products obscure other activities that are also of significance. For this reason, we present a second panel in Figure 16 without computer, electronics and optical products.

Figure 16   A closer look at trademark-intensive manufacturing activities – the Philippines
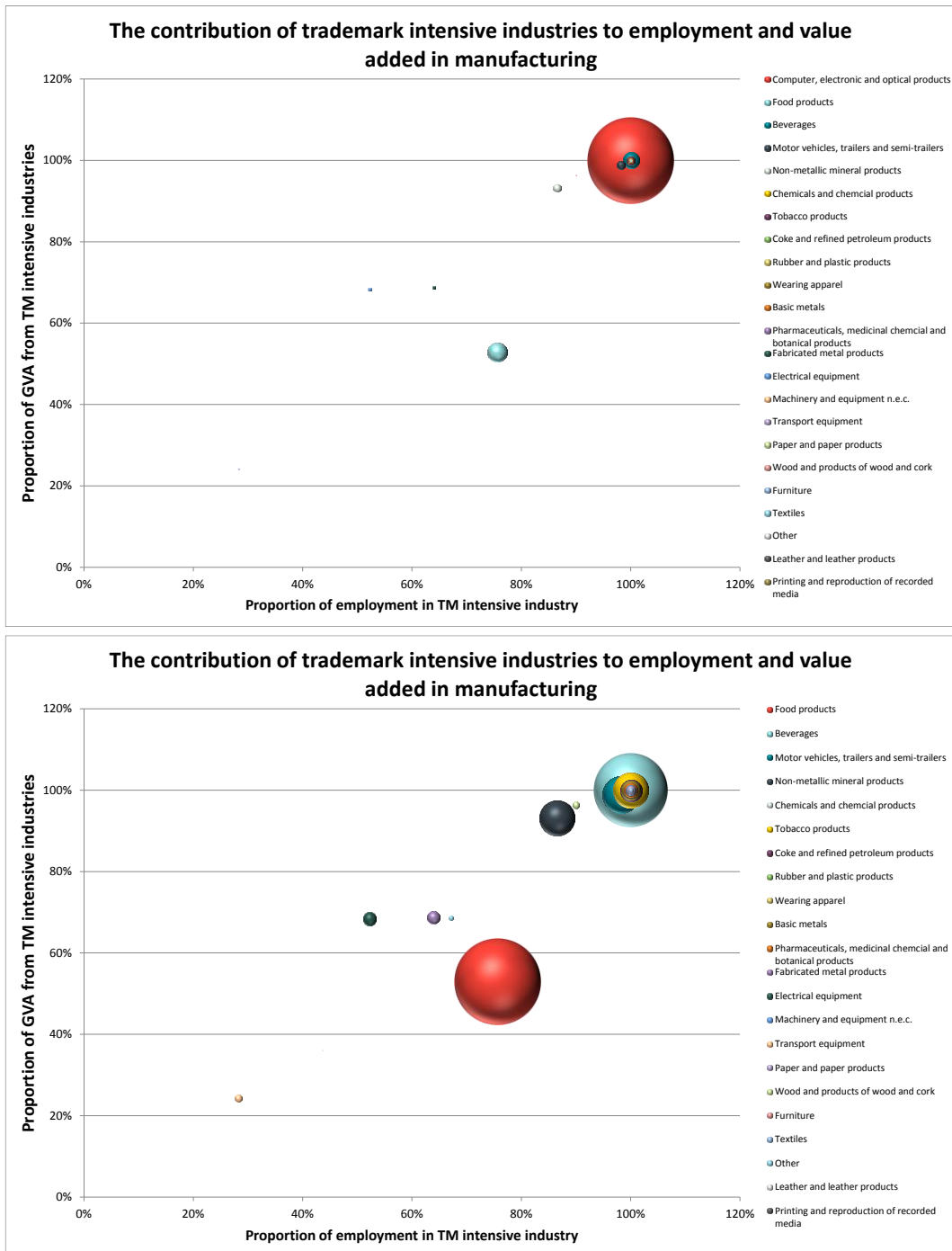
Source: Frontier Economics based on CPBI/ PSA data

Through this second panel we observe the importance beverages in terms of overall size as well as trademark intensity. Food manufacturing is of similar importance in terms of overall size but is less trademark-intensive according to the two metric selected. Motor vehicles, tobacco and pharmaceuticals are examples of smaller activities, in terms of overall size, but that are at the upper end of trademark-intensiveness.

2.4.2 Indirect effects

We follow the methodology, developed in section 2.2.2, to derive estimates of the indirect contribution of trademark-intensive industries in the Philippines.

Figure 17 reports the indirect contributions of trademark-intensive industries via their interdependencies with other sectors. We note that, unlike Thailand and Malaysia, agriculture is not one of the sectors identified as an "indirectly" trademark-intensive sector: its consumption of trademark-intensive inputs is lower than the threshold we have set for identifying activities that are dependent on linkages to trademark-intensive industries. Significant sectors (in terms of contribution to value-added) that are not trademark-intensive in and of themselves, but nevertheless show significant dependence on trademark-intensive industries, include education, and financial intermediation.

When indirect contributions are taken into account, the share of GDP of trademark-intensive industries in the Philippines rises to just over 28%. If we include agriculture, which does not lie very far below the threshold we have used for identifying sectors that are dependent on trademark-intensive industries, the indirect contribution of these industries rises to a little over 41%.

Figure 17. Indirect contribution of trademark-intensive activities by sector
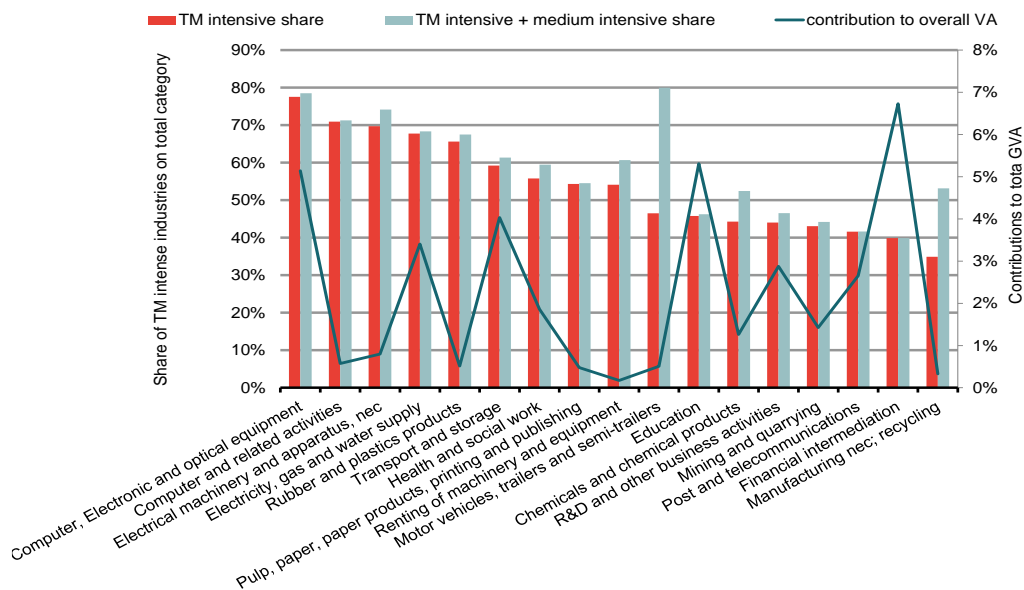
Source: Frontier Economics based PSA input-output table data

Based on input-output analysis, we estimate that the share of exports accounted for by trademark-intensive sectors (directly and indirectly) is around 47%.

2.5 Indonesia

2.5.1 Direct contributions

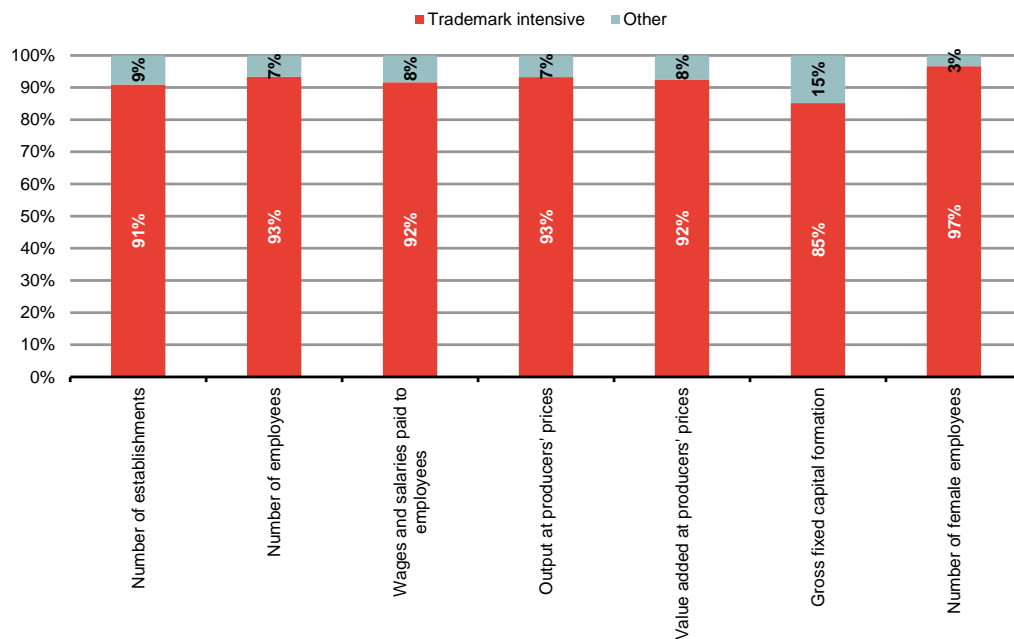Our study of Indonesia was affected by data constraints, both in terms of trademark registrations and in terms of sector performance data. On the latter front, it was necessary to draw on data sourced from UNIDO[21] to make up for data shortcomings from national sources. The UNIDO data cover manufacturing activities only.[22] Hence, metrics measuring direct contributions are for manufacturing activities only. Based on data for manufacturing alone, the direct contributions of trademark-intensive industries come to around 21% of overall (i.e. economy wide) value added.

For indirect contributions, we were able to estimate the contribution of services by identifying which services sectors were trademark- intensive in other ASEAN economies, and mapping these to Indonesia.

As with the five other countries, trademark-intensive activities dominate manufacturing activities.

Figure 18. Trademark-intensive manufacturing relative to all manufacturing

Legend: ■ Trademark intensive ■ Other

Category	Trademark intensive	Other
Number of establishments	91%	9%
Number of employees	93%	7%
Wages and salaries paid to employees	92%	8%
Output at producers' prices	93%	7%
Value added at producers' prices	92%	8%
Gross fixed capital formation	85%	15%
Number of female employees	97%	3%

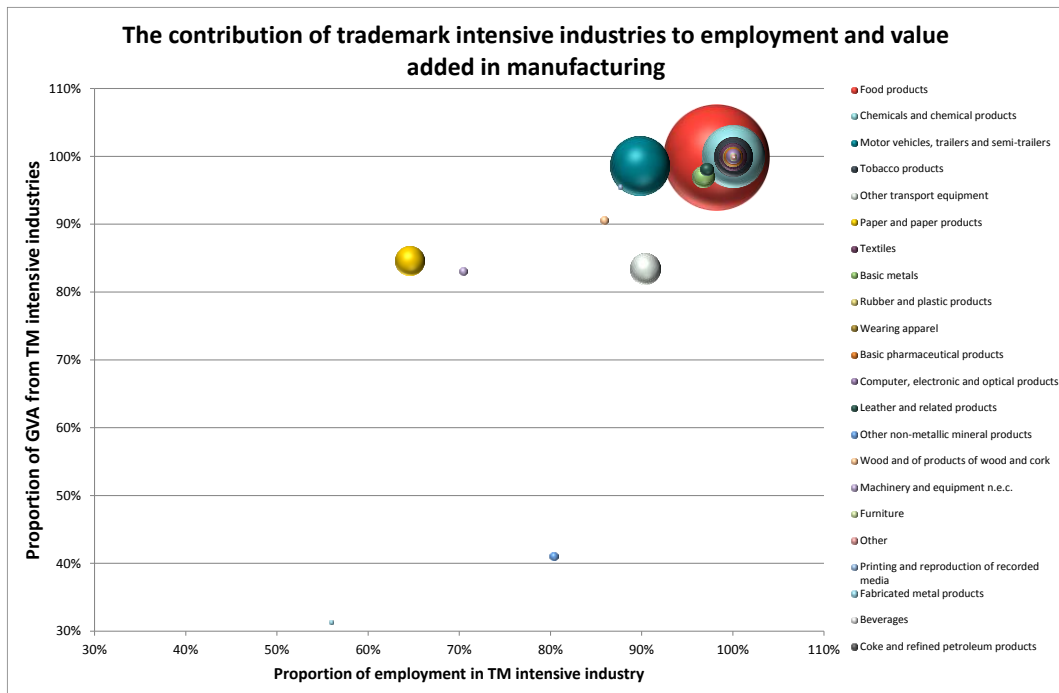*Source: Frontier Economics calculations based on UNIDO data*

A closer examination of manufacturing activities highlights the role of food products, and to a lesser extent, chemicals and chemical products, and motor vehicles.

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[21]   INDSTAT 4 2016, ISIC Revision 4, http://www.unido.org/index.php?id=1002103

[22]   That still allows us to capture 165 out of 277 trademark-intensive industries as defined by the EUIPO

**Figure 19.   A closer look at trademark-intensive manufacturing - Indonesia**

The contribution of trademark intensive industries to employment and value added in manufacturing

Legend:
- Food products
- Chemicals and chemical products
- Motor vehicles, trailers and semi-trailers
- Tobacco products
- Other transport equipment
- Paper and paper products
- Textiles
- Basic metals
- Rubber and plastic products
- Wearing apparel
- Basic pharmaceutical products
- Computer, electronic and optical products
- Leather and related products
- Other non-metallic mineral products
- Wood and of products of wood and cork
- Machinery and equipment n.e.c.
- Furniture
- Other
- Printing and reproduction of recorded media
- Fabricated metal products
- Beverages
- Coke and refined petroleum products

Source: Frontier Economics calculations based on UNIDO data

2.5.2 Indirect effects

An input-output table (2011) enables us to work out the indirect contributions of trademark-intensive industries. To work around the issue of services sector data, it was necessary to establish a methodology to identify which of the services sectors identified at the two-digit SIC level[23] by the input-output table could be considered trademark-intensive. The methodology we used was to identify trademark-intensive services sectors in the four other countries in this study. In essence, if a particular sector was identified as trademark-intensive in at least two of the other countries studied, it was considered to be trademark-intensive in Indonesia.

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[23]   The Standard Industrial Classification is a methodology used internationally for classifying industrial activities. At its most disaggregated, the SIC is presented at the 4 digit level. The 2 digit level consists of major groupings e.g. 01 is Agricultural Crop Production; 35 is Industrial and Commercial Machinery and Computer equipment.

Figure 20. Indirect contribution of trademark-intensive activities by sector
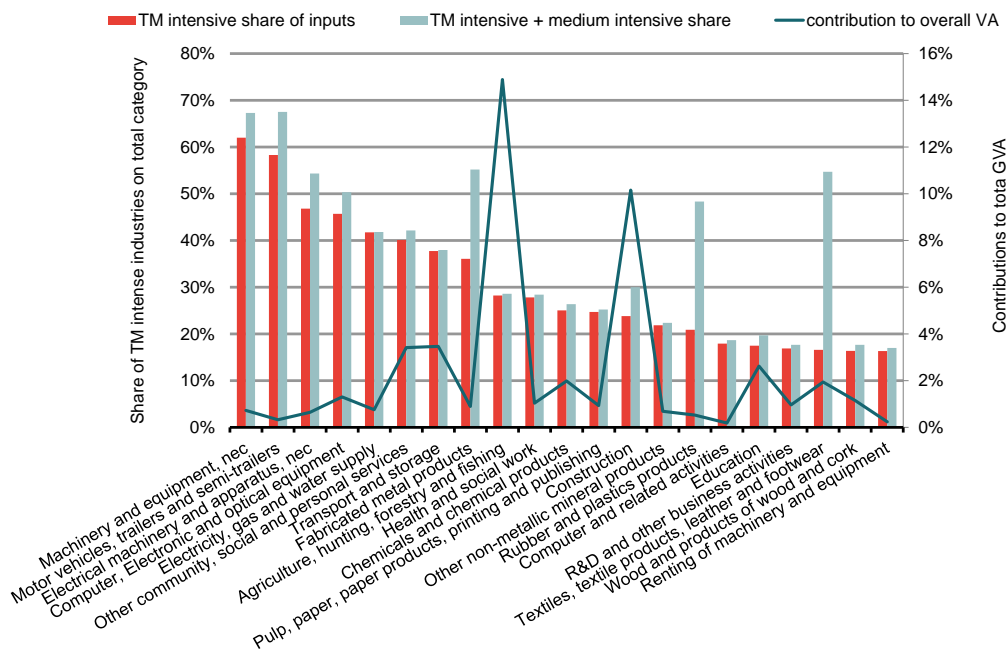
The overall indirect contribution of trade-mark intensive industries is around 51% of value added. We note that agriculture and construction, two sectors that are not in and of themselves trademark-intensive, have significant linkages to trademark-intensive sectors, principally manufacturing.

Trademark-intensive activities account for up to 27% of Indonesia's exports.

2.6 Singapore

2.6.1 Direct contributions

Measures of direct contributions of trademark-intensive industries to Singapore show a similar pattern to that seen in the other countries covered in this study: trademark-intensive industries tend to punch above their weight, when measures of their contributions are compared to the number of businesses. This can be seen in Figure 21 below. The direct contributions of the trademark-intensive industries account for an estimated 50% of gross value added, considerably higher than is the case for other countries in the study.

UNIDO survey data for Singapore cover manufacturing activities[24], but not services. We infer services employment by using GVA to employee ratios and

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[24]   INDSTAT 4 2016, ISIC Revision 4

applying these to overall services GVA.[25] This approach yields an estimate that around 29% of employment takes place in trademark-intensive industries.

Figure 21.   Trademark-intensive sectors relative to all sectors
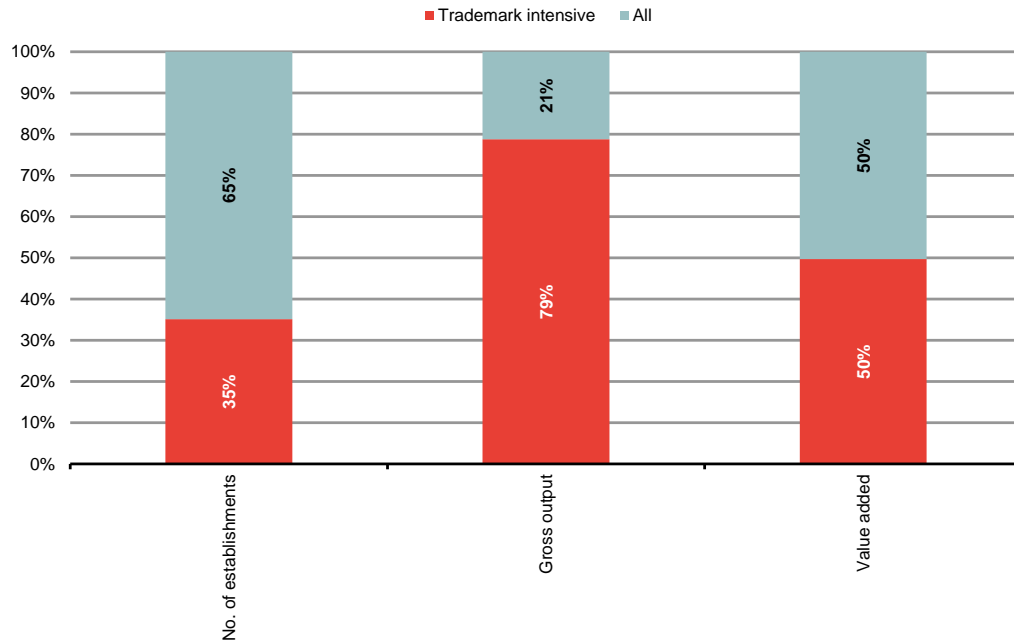
Source: Frontier Economics calculations based on UNIDO and Singstat

Manufacturing activities account for the majority of trademark-intensive industry contributions to the Singapore economy accounting for around 26% of value added. But in contrast to the other four economies, trademark-intensive services also play a significant role. The main ones are wholesale and retail activities (18% of value added) and information and communication (4%).

Figure 22.   Three largest trademark-intensive sectors

Contributions of TM intensive industries within three selected sectors

Legend:
- C - Manufacturing
- G - Wholesale and retail trade; repair of motor vehicles and motorcycles
- J - Information and communication
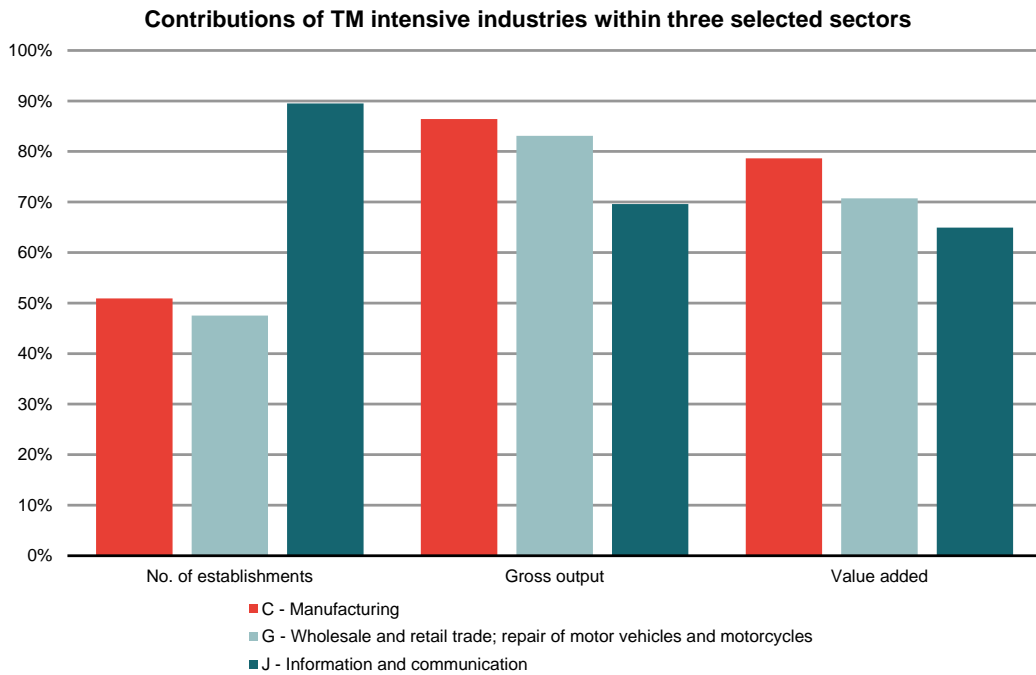
Source: Frontier Economics calculations based on UNIDO and Singstat

Figure 23 presents a deeper look at the manufacturing sector. Within trademark-intensive manufacturing, computer and electronic equipment manufacturing dominates. It accounts for nearly 21% of total manufacturing value added. The manufacture of other various other machinery and (excluding motor vehicle equipment) accounts for a further 13% of manufacturing value added.

Figure 23. **A closer look at trademark-intensive manufacturing - Singapore**

The contribution of trademark intensive industries to employment and value added in manufacturing
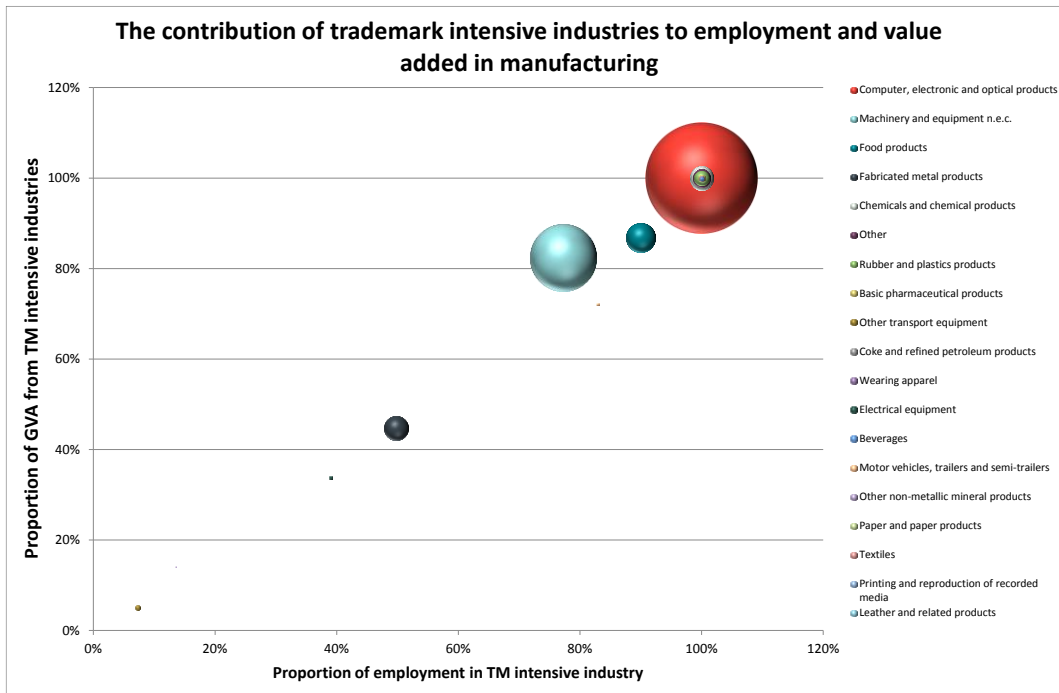
Source: Frontier Economics calculations based on UNIDO and Singstat

2.6.2 Indirect effects

We follow the approach outlined in section 2.2.2 to infer the indirect contributions of trademark-intensive industries. These are depicted through Figure 24 below.

Figure 24. Indirect contribution of trademark-intensive activities by sector
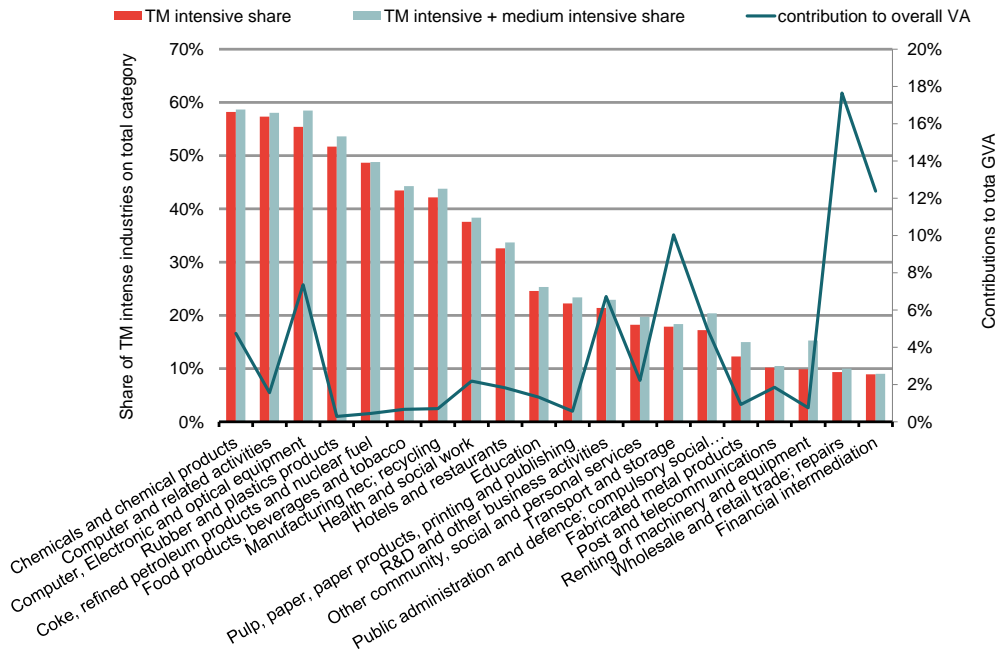
We observe that computer, electronics and optical equipment is a sector that has strong indirect contributions in addition to its direct ones, mainly on account of the intra-industry linkages that exist. In contrast to the other countries in this study, Singapore does not have substantial agricultural sector. It will be recalled that the strong inter-linkages between this sector and trademark-intensive sectors significantly boosted the indirect economic contributions of the latter. Financial intermediation is another substantial economic activity in Singapore, but one that presents weaker linkages with trademark-intensive activities. Overall, when indirect impacts are taken into account, trademark-intensive industries contribute to around 55% of value added.

Trademark-intensive industries directly and indirectly account for around 63% of total merchandise exports.

3 ECONOMETRIC ANALYSIS

3.1 Objectives and approach

The preceding analysis presents a snapshot view of trademark-intensive industries drawing on national accounts and industry survey data. The analysis is useful in identifying direct contributions of these industries, and the indirect linkages that drive their broader economic footprint. The data are valuable in helping us to identify the main performance metrics for these industries, and to place them within a broader economic narrative concerning the countries under study.

But in order to deepen the analysis, it is worthwhile considering what the economic payoff for an economy would be from allocating more resources to trademark-intensive industries relative to non-trademark-intensive ones. In order to do this, we develop an econometric model relating trademark-intensiveness to measures of economic performance. Specifically, we look at effects on value added per worker and on export performance. The aim of the model is to estimate the responsiveness of these measures to trademark intensity.

3.2 Results[26]

3.2.1 Basic model

Our basic model measures the log of value added per worker, and measures the effects of trademark intensity once country specific factors are controlled for. To measure the effects of trademark intensity, we develop a dummy variable, which is assigned a value of one if an industry is trademark-intensive, or zero if it is not. This is in line with the EUIPO/EPO methodology, which classifies industries as either trademark-intensive or not. We use the work conducted in section 2 to provide us with data on trademark-intensive industries.

We also use country specific dummy variables. The intuition here is that value added per worker will also reflect country-specific factors, including policy and institutional factors.

We run two versions of the basic model:

- In the first, we pool data across all five of the target countries. This "pooled model" helps us to work out what the effect is, on average, for the five countries as a whole, how much value added per worker would increase following a switch from non-trademark-intensive to trademark-intensive (the "trademark effect").

- In the second, we run separate equations for each of the five countries, to estimate the "trademark effect" in each of these countries.

The first variant of the basic model projects a relatively strong result: switching from a non-trademark-intensive industry to a trademark-intensive one is associated with

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an increase in value-added per worker by around 93%, once country-specific characteristics are taken into account.

The results could be interpreted as suggesting that there is a strong jump in productivity when moving from non-trademark-intensive to trademark-intensive activities. This is a plausible result given that non-trademark sectors include, in four of the countries mentioned, significant primary sectors in which productivity tends to be low.

If we consider the second variant, which estimates the trademark effect for each of these countries, we observe that the effect is significant and strongly positive for four countries: Malaysia (108%), Philippines (100%), Singapore (82%), and Thailand (95%). Indonesia is the exception: we discern no statistically significant "trademark effect". This is not to say that trademark-intensive industries do not contribute to the Indonesian economy; rather it is that their contribution is not significantly different to non-trademark-intensive industries.

The positive results for the four countries mentioned are in line with the overall result. Singapore's result – which is lower than the average – may reflect the fact that as the most advanced and outward oriented (in terms of trade as a share of GDP) economies in the group, productivity levels are generally high. Hence the increase in moving from non-trademark-intensive to trademark-intensive is likely to be more moderate.

The result for Indonesia could be attributed to several factors. On the data front, limitations in services data may affect the estimates. Secondly, the composition of trademark-intensive manufacturing in Indonesia is dominated by food and beverages, rather than computers and electronics, as is the case in other jurisdictions. Computers and electronics are sub-sectors in which cross-border supply chains have developed rapidly in the last two decades, a phenomenon associated with rapid productivity growth. It may thus be that Indonesian manufacturing is concentrated in areas that have seen slower productivity growth. This could be compounded by the legacy of extensive state ownership in the economy, and by the fact that trade has still accounts for a relatively limited share of economic output.[27] Both factors could adversely affect productivity.

Finally, another explanation could lie in differences between Indonesia and the rest of the group in terms of trademark protection. Various concerns have been expressed, for instance, by Indonesia's trade partners on the desirability of strengthening the enforcement of IPR protection.[28] If enforcement is a problem, it would tend to reduce value added in industries that are notionally deemed to be trademark-intensive.

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[27] The point is made particularly in WTO(2013), *Trade Policy Review of Indonesia, Report by the Secretariat*, page 7.

[28] Commenting on the government's attempts to reinforce intellectual property protection, Indonesia's representative to the WTO acknowledged the enforcement of IPRs "poses a great challenge to the Government" , noting particularly Indonesia's complicated geography. (see WTO 2013, Trade Policy Review, Indonesia, Report of the Meeting, Doc WT/TPR/M/278 p7.)

3.2.2 Extended modelling

Controlling for the effects of forms of IPR other than trademarks

Businesses often rely on a number of forms of intellectual property right protection. There is a strong degree of overlap between a sector's TM intensity and other IP intensity.

This is shown in the Venn diagram below, which analyses the overlap between industries defined in the EUIPO/ EPO study according to their intensity in terms of different types of IP rights. Of patent-intensive industries 84% are also TM-intensive. Of copyright-intensive industries, 62% are also TM-intensive. As a result, it may be difficult to distinguish the effect of TM from other types of IP. The correlation is particularly high with respect to patents, but fairly low for copyright (see Figure 25 and table 2).

Figure 25.   Venn diagram of TM, patent and copyright intensity at 4-digit SIC level
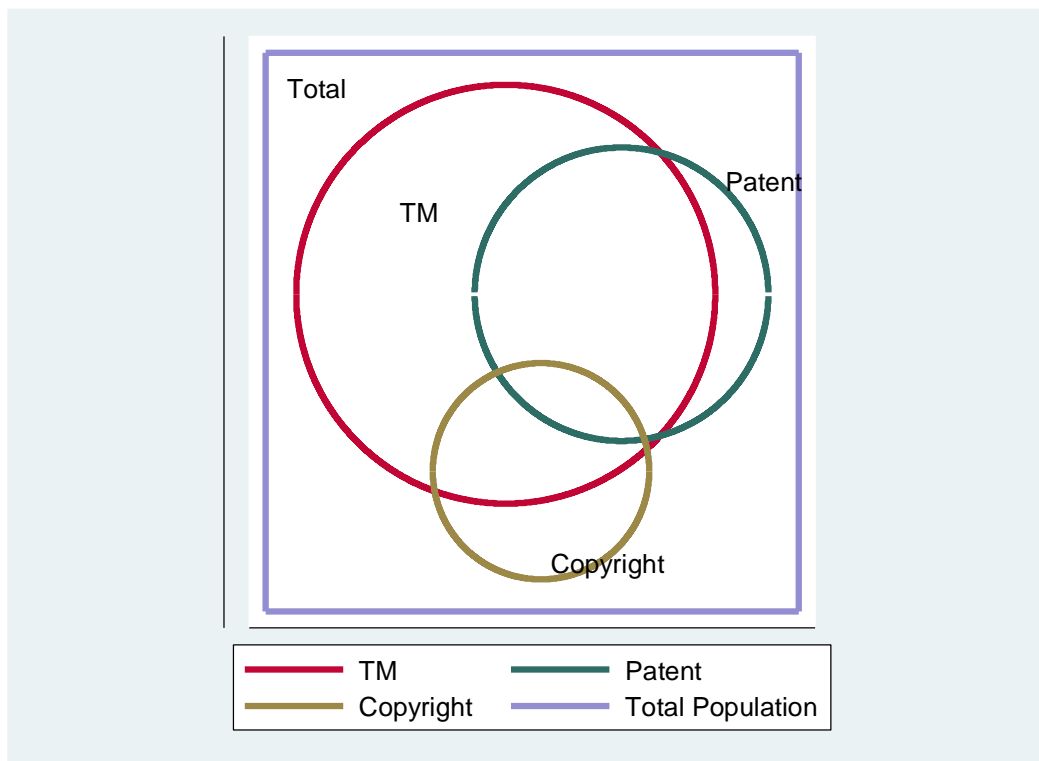
Source: Frontier analysis using EUIPO/EPO intensity definitions applied to

Table 2   Correlation matrix of different types of IP intensity

	TM	Patent	Copyright	Design	Patent, Copyright or Design
TM	1.00				
Patent	0.41	1.00			
Copyright	0.12	-0.04	1.00		
Design	0.40	0.78	0.54	1.00	
Patent, Copyright, or Design	0.55	0.60	0.42	0.78	1.00

Source: Frontier analysis of EUIPO.

We re-estimate the "pooled model" described in section 3.2.1 by selectively adding further measures of IPR: copyright, patent and design.[29] These indicators are also drawn from the EUIPO classification of IP-intensive industries and derived in exactly the same manner as the trademark-intensity measure, i.e. the share of activity that is intensive in that particular type of IP. While copyright and design make little difference to the effect of estimated trademark effect, when patent-intensity is controlled for, the effect of trademark-intensity becomes smaller. A move from zero trademark-intensity to intensity of one is associated with a 57% increase in value added per employee.

This would suggest that part of the effect measured by trademark (in isolation) in section 3.2.1 captures the effects of patents.

Effects on exports

The analysis focuses on exports as a share of total output. This analysis is done at a more aggregated level using data from OECD input-output tables and uses country-specific dummies to control for different export propensities in different countries. In each of the five countries analysed, trademark-intensive industries consistently export a higher share of their output than non-intensive industries do. Overall, we find that moving from a trademark intensity of zero to one is associated with an 11 percentage point increase in exports as a share of output. This is a fairly large increase, given that average export share per sector ranges from 12% for Indonesia to 43% for Singapore.

In the case of exports, it is harder to distinguish the effects of the different types of IPR, and the effect of trademark intensity can become positive but statistically insignificant. We therefore employ a statistical technique (principal components analysis) to split apart a general effect of IPRs from the specific effect of particular types of IPR, i.e whether the effect is due to trademark, patent, copyright, etc. This approach finds that general IP-intensity has an effect on exports share; however, we cannot separate out the different contributions of specific types of IPRs.

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[29] Although Plant Variety Rights (PVR) and Geographical Indication (GI) are also included as separate categories in the EUIPO classification, they only relate to a very small number of sectors, so are not analysed here.

3.3 Conclusion

The purpose of the econometric analysis was to build on and extend the analysis presented in section 2. In particular, the econometric analysis in intended to answer the question of how much extra value is delivered by trademark-intensiveness.

The econometric analysis suggests that for the set of countries as a whole, the effects of trademark-intensiveness on value added per worker are strongly positive and significant. We find that, as an upper bound of, the trademark-intensiveness effect increases value added per worker by around 90%. Since patent protection is strongly correlated with trademark protection, we can try and filter out the effects of patent to identify the effects of trademarks alone. Our modelling suggests a trademark effect of around 57%, once patents are controlled for. We can interpret this figure as the lower bound for the trademark effect i.e. for the countries as a whole, the trademark effect could lie between 57% and 90%.

The strong and positive effects are reflected in four of the five countries studied. They make intuitive sense when we consider the sectors that are most trademark-intensive tend to be more export-oriented (which tends to increase productivity per worker), and that these sectors also compare with significant primary sectors in which productivity tends to be low.

By contrast, we find a statistically insignificant result for Indonesia, which may partly be a reflection of data availability, but could also be a reflection of lacunae in trademark enforcement in the country.

4 SUMMARY AND POLICY IMPLICATIONS

4.1 Summary observations about main findings

The study documents the significant role played by Trademark-intensive industries in the countries covered by this study. The direct contributions of these industries are valued between just under a fifth (the Philippines) to just under a third (Malaysia) of national GDP. This compares with a figure of around 36% measured for the EU. In making comparisons, it should be borne in mind that the numbers for the ASEAN economies are based on formal sector activities. The informal sector in some of the countries concerned is significant: hence, the numbers for the ASEAN economies (apart from Singapore) should be treated as an upper bound.

The contribution to GDP rises when indirect effects via input-output linkages are taken into account. These range from a low of 28% the Philippines, to a high of around 60% in Malaysia. The magnitude of these indirect linkages is mainly attributable to the dependencies of primary activities (agriculture, natural resources and extractive activities) on inputs from trademark-intensive sectors. This is notably true in Malaysia, which has significant primary sector activities. The Philippines is an outlier in that its agricultural sector exhibits a relatively low level of dependence on trademark-intensive sectors.

Trademark-intensive industries play a significant role in the labour market. Their contribution to employment is between 38% and 50%. As with GDP figures, these numbers should be treated as an upper bound, given the size of the informal economy in countries outside Singapore. There is also evidence of a wage premium: remuneration in trademark-intensive industries is between 12% and 30% higher than in non-trademark-intensive industries.

The results also bring out the significant role played by trademark-intensive manufacturing activities, which in each of the countries studied accounted for the bulk of direct economic contributions by trademark-intensive industries. And trademark-intensive industries are also important to manufacturing, accounting for upwards of 80% of sector GDP.

Within manufacturing, computers, electronic and related products are significant by their level of trademark-intensiveness and their overall economic importance. This is especially true in Malaysia, the Philippines, Singapore, and Thailand. This observation fits into a wider narrative about the way in which international trade has developed in the last two decades, along the lines of cross-border supply chains. Within these supply chains, countries specialise in certain aspects of the production process. East and South East Asia have been at the heart of this development[30] Computers and electronics are an example, *par excellence*, of industries that operate through cross-border supply chains, and the ability of economies to attract industries such as these is an important contributor to their economic performance.

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[30] See for instance, WTO./ IDE-JETRO (2013), *Trade patterns and global value chains in East Asia: From trade in goods to trade in tasks*.

This reflects the integration of these countries into cross-border supply chains responsible for the manufacture of these products. Motor vehicles in Malaysia follow a similar pattern i.e. trademark-intensive and integrated into cross-border supply chains.

Beverages, and to a lesser extent, food, are trademark-intensive and economically significant across most of the countries studied. For some of these activities, proximity to raw materials and labour costs are an important factor in attracting export-based agro-processing activities. In other cases, international producers need local presence in order to calibrate product ranges and attributes to local consumer tastes, and compete with national producers.

The connection between trademark-intensive industries and manufacturing is significant, given the importance attached by policymakers to manufacturing (and, for reasons explained above, manufacturing operating on the basis of cross-border supply chains) as an engine of economic growth. The evidence suggests that trademark-intensive industries will take centre-stage in understanding the growth prospects for manufacturing.

The econometric analysis provides further guidance as to the economic payoffs of trademark-intensiveness for the five countries. We calculate that the "trademark-intensiveness effect" increases value added per worker by around 90% for the five countries as a whole. This is an upper bound: if we control for the effects of other types of IPRs (notably patents), we find a figure or around 57%.

The strong effects detected through the econometric analysis ties in well with the overall narrative emerging from the country analysis. In particular:

- The performance of trademark-intensive sectors is usually set against a number of sectors (notably primary activities such as agriculture) in which productivity is lower.

- Certain strongly trademark-intensive sectors (notably computers etc) are export-oriented via their integration into global supply chains. Generally speaking the evidence suggests that export-competing sectors tend to have higher levels of productivity.[31] The productivity effects are also consistent with the higher wages associated with trademark-intensive businesses.

The econometric evidence at a country level suggests that the general result holds for individual countries as well. The exception is Indonesia, for which the trademark-intensiveness variable does not seem to have a significant effect on value-added per worker. While this may be partly an artefact of data limitations, it may also point to lacunae in the enforcement of IPRs.

4.2 Policy implications

The study points to the significant footprint of trademark-intensive industries in these five countries, and the potentially strong effects that can deliver on key performance metrics such as value added per worker and exports. From a policy

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[31] See notably, Francisco Alcalá and Antonio Ciccone (2004), "Trade and Productivity" in *Quarterly Journal of Economics* Vol 119. No.2; and Thorsten Schank, Claus Schnabel, Joachim Wagner (2007) "Do exporters really pay higher wages? First evidence from German linked employee data", *Journal of International Economics* Vol. 72,Issue 1.

perspective, these findings are of interest given the importance attached to export-oriented growth for the region, and specifically, growth that involves moving into higher value-added and less "commoditised" production.

The contribution of this research is that it suggests that trademark protection has a role to play in such a strategy. In particular the study has highlighted the nexus that exists between trademark-intensiveness, export orientation, and productivity, with productivity being the main long-run driver of economic growth. This is not to say that trademark protection will automatically boost an economy's growth prospects. That depends on a number of other policy and institutional factors, ranging from the configuration of trade policy to the ease of enforcing contracts. Rather, it is that initiatives in this area are likely to complement other initiatives to strengthen the framework for private sector investment and production.

The findings of the report fit in with broader findings on the role of IPR protection. The fact that trademark intensity is strongly correlated with other forms of IPR protection (notably patent protection) suggests that approaches to trademark protection should be considered holistically, and not in isolation from the framework for IPRs generally.

Generally speaking, the countries studied have made efforts to strengthen IPR enforcement, and the protection of trademarks specifically. For Indonesia, where we observe no statistically significant trademark effect, the results for the other countries point to the benefits that may be derived from addressing any lacunae in trademark protection.

APPENDIX 1 – ECONOMETRIC STRATEGY

MAIN FINDINGS

Sectors with greater TM intensity tend to have higher value added per employee. This relationship is statistically significant. However, it varies by country and appears stronger with respect to the services sector. We also see that TM intensity is correlated with exports taking a higher share of output. Moving from TM intensity of zero to one is associated with a near doubling in value added per worker. Exports as a share of output are increased by 10 percentage points.

TM intensity is correlated with other aspects of IP, particularly patent intensity. This may make it difficult to attribute the observed relationships to any one particular type of IP. In the case of value added per employee, we continue to see a significant relationship even when controlling for other IP types. However, in the case of export share, it is difficult to distinguish the effects of different IP types above and beyond a general common effect.

Data

We use national accounts statistical indicators by industry for 5 ASEAN countries. These datasets include variables such as employment, value added, wages, turnover and number of units. This data is at NACE level. Note that coverage varies by country and industry, e.g. Indonesia does not have any services data.

We combine the national accounts data with the EUIPO categorisation of IP-intensive industries. EUIPO classifies industries along the following dimensions of IP: Trademark, design, patent, copyright, geographical indication, and plant variety rights. This is a binary classification: on each of these dimensions an industry is either intensive or it is not.[32]

We consolidate the data to NACE 2-digit level, at which there are 84 different sectors ('divisions'). We create measures of TM intensity to record the share of employment within a division that is in TM-intensive industries. For example, if division X includes sector X.1 (TM-intensive, employment = 5000) and X.2 (non TM-intensive, employment = 15000), then overall it has an employment TM intensity of 25%. IP intensity measures are calculated for each of the 6 types of IP and for each of the 5 activity measures (employment, value-added, etc.).

Note that the same EUIPO classification is applied across all countries, so at this level there will be no variation in IP intensity across countries for a given 4-digit industry. Cross-country variation in IP intensity for a given sector arises at the 2-

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[32] The EUIPO categorisation is on the basis of ISIC codes, which requires manual matching to the NACE codes, which is time-consuming and in some cases imperfect. Due to these issues and other limitations, we create only a single cross-section, i.e. do not repeat the exercise for multiple years.

digit level if the mix of component 4-digit industries varies, e.g. if fish processing is TM-intensive and fruit processing is not, their relative weights will affect the average for food manufacturing. Of the variation in TM intensity, 85% is at sector level and the remaining 15% reflects inter-country variation.[33]

General model

The dependent variable is the log of value added per employee. We regress this against TM intensity[34] and country dummies. Moving from TM intensity of zero to TM intensity of one is associated with a 93%[35] increase in value added per employee, which is statistically significant (column 1). Note that financial variables are recorded on a number of different currency bases. However, since we use a log dependent variable, the country dummies already pick up any cross-country variation in value added per employee (including currency effects) and the coefficient of interest (TM intensity) does not vary with respect to the currency bases or any rescaling.

We also analyse the relationship separately for each of the different countries in turn (columns 2-6). For four of the countries, the effect is positive and statistically significant. For Indonesia the relationship is negative and insignificant.

The models can be written as follows:

(EQ1) Pooled model with country dummies:

$Log (valueadd/employee_{ic}) = b0 + b1TM\_intensity_{ic} + dummy_c + u_{ic}$

(EQ2) Disaggregated by country model:

$Log (valueadd/employee_{ic}) = b_c + b1_c TM\_intensity_{ic} + u_{ic}$

for sector i in country c.

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[33] Pooled regression of TM_inensity on sector dummies has R-squared of 0.86. For manufacturing sectors the R-squared is 0.77, but for services sectors it is 0.97. So, while there is a degree of inter-country variation in TM intensity for a given manufacuring industry, there is very little for services sectors.

[34] The TM intensity measure used here is the average of employment, value added, and number of units. The results change very little if we instead use one of the specific components.

[35] With a log dependent variable the effect of moving from TM=0 to TM=1 is given by exp(0.66*1)-1 = +93%.

Table 2   Regression results for country dummy and single country models

	(1) Pooled	(2) Malaysia	(3) Indonesia	(4) Singapore	(5) Thailand	(6) Philippines
MYS dummy	0.460					
	(1.97)**					
PHL dummy	-0.093					
	(0.41)					
SGP dummy	1.401					
	(5.02)***					
THA dummy	-0.311					
	(1.32)					
TM intensity	0.657	0.734	-0.190	0.597	0.665	0.693
	(4.51)***	(2.87)***	(0.20)	(1.31)	(2.99)***	(2.54)**
Constant	9.377	9.797	10.068	10.810	9.062	9.269
	(41.37)***	(56.83)***	(12.17)***	(34.57)***	(61.13)***	(56.40)***
R-squared	0.27	0.13	0.00	0.08	0.14	0.07
Adjusted R-squared	0.26	0.11	-0.04	0.03	0.13	0.06
N	244	59	24	23	55	83

Source: Frontier analysis of EUIPO and national accounts data

*Note: T-statistics in parentheses, * $p<0.1$; ** $p<0.05$; *** $p<0.01$*

Controlling for other IP intensity

There is a strong degree of overlap between a sector's TM intensity and other IP intensity. This is shown in the Venn diagram below. Of patent-intensive industries 84% are also TM-intensive. Of copyright-intensive industries, 62% are also TM-intensive. As a result, it may be difficult to distinguish the effect of TM from other types of IP. The correlation is particularly high with respect to patents, but fairly low for copyright (see Figure 4).

Exhibit 26. Venn diagram of TM, patent and copyright intensity at 4-digit SIC level
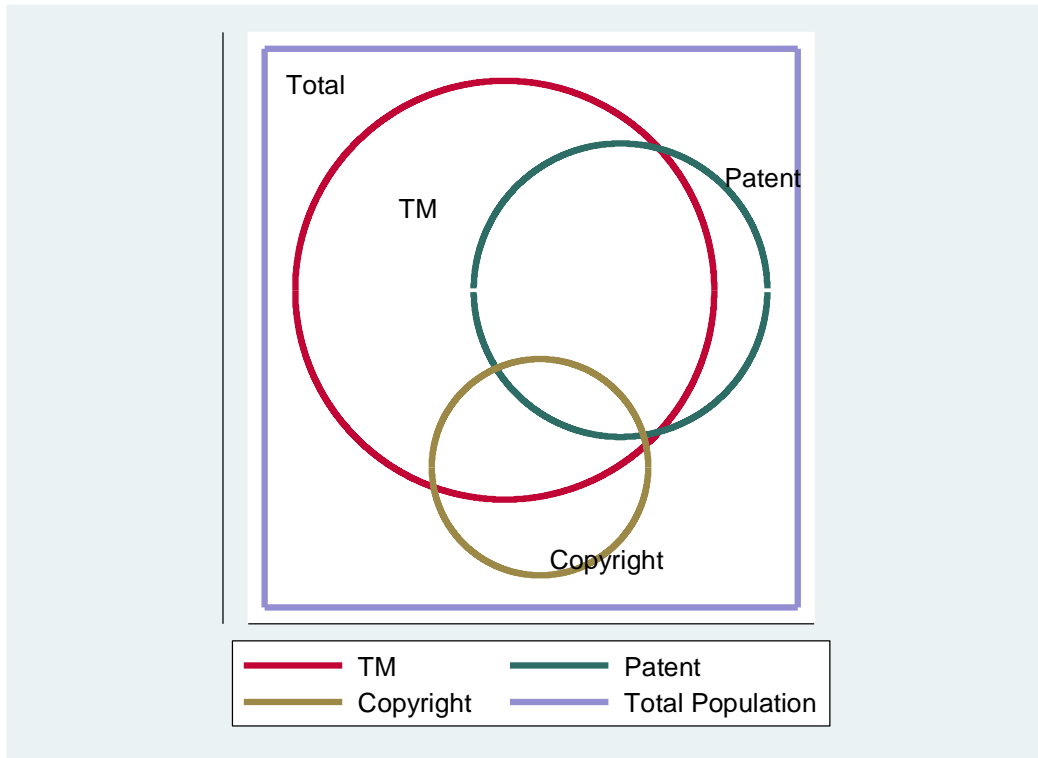
Source: Frontier analysis of EUIPO

Table 3   Correlation matrix of different types of IP intensity

	TM	Patent	Copyright	Design	Patent, Copyright or Design
TM	1.00				
Patent	0.41	1.00			
Copyright	0.12	-0.04	1.00		
Design	0.40	0.78	0.54	1.00	
Patent, Copyright, or Design	0.55	0.60	0.42	0.78	1.00

Source: Frontier analysis of EUIPO and national accounts data

In Figure 5 we selectively add additional patent, copyright and design IP measures into the regression, as well as a joint measure of non-TM IP intensity. This can be written:

(EQ4) Pooled model with country dummies and other IP measure

$Log (valueadd/employee_{ic}) = b0 + b1TM\_intensity_{ic} + b2otherIP\_intensity_{ic} + dummy_c + u_{ic}$

While copyright and design make little difference to the effect of TM, when patent intensity is added, the effect of TM intensity becomes smaller. This is also seen

with the joint IP variable in specification (5). This would suggest that part of the effect measured by TM (in isolation) is in fact due to patent intensity.

Table 4   Regression results for model with multiple IP measures and country dummies

	(1)	(2)	(3)	(4)	(5)
MYS dummy	0.460	0.666	0.446	0.438	0.520
	(1.97)**	(2.90)***	(1.90)*	(1.82)*	(2.22)**
PHL dummy	-0.093	0.110	-0.107	-0.114	-0.030
	(0.41)	(0.49)	(0.47)	(0.49)	(0.13)
SGP dummy	1.401	1.413	1.399	1.401	1.389
	(5.02)***	(5.26)***	(5.01)***	(5.02)***	(5.00)***
THA dummy	-0.311	-0.109	-0.326	-0.330	-0.261
	(1.32)	(0.47)	(1.38)	(1.37)	(1.11)
TM intensity	0.657	0.454	0.641	0.689	0.493
	(4.51)***	(3.07)***	(4.32)***	(4.08)***	(2.88)***
Patent intensity		0.717			
		(4.41)***			
Copyright intensity			0.108		
			(0.59)		
Design intensity				-0.073	
				(0.39)	
Patent / Copyright or Design					0.307
					(1.81)*
Constant	9.377	9.116	9.378	9.401	9.254
	(41.37)***	(40.30)***	(41.32)***	(39.92)***	(39.30)***
R-squared	0.27	0.33	0.27	0.27	0.28
Adjusted R-squared	0.26	0.31	0.25	0.25	0.26
N	244	244	244	244	244

Source: Frontier analysis of EUIPO and national accounts data

*Note: T-statistics in parentheses, * p<0.1; ** p<0.05; *** p<0.01*

Effect on exports

We can also explore the relationship between TM intensity and exports by using data from OECD input-output tables. This involves consolidating the data to the more aggregated level at which input-output analysis is reported (34 different sectors). The dependent variable becomes exports as a share of total output. Below we show results for the pooled and single-country models (i.e. variants of equations (EQ1) and (EQ2), with export share as dependent variable).

In the pooled model we see a positive and significant effect of TM intensity on export share of output. Moving from TM intensity of 0 to 1 is associated with an 11 percentage point increase in exports as a share of output. For each of the country-

level models, exports are positively correlated with TM intensity, although only in the case of Malaysia is this relationship statistically significant. If sector dummies are added (as per EQ3), the effect becomes positive but statistically insignificant.[36]

Table 5   Export model regression results for country dummy and single country models

	(1) Pooled	(2) Malaysia	(3) Indonesia	(4) Singapore	(5) Thailand	(6) Philippines
MYS dummy	0.103					
	(2.60)**					
PHL dummy	0.023					
	(0.58)					
SGP dummy	0.457					
	(7.82)***					
THA dummy	0.124					
	(2.85)***					
TM intensity	0.114	0.213	0.129	0.083	0.052	0.085
	(2.54)**	(3.01)***	(1.37)	(0.59)	(0.44)	(1.14)
Constant	0.088	0.136	0.076	0.561	0.247	0.125
	(2.16)**	(2.64)**	(1.13)	(4.48)***	(3.33)***	(2.87)***
R-squared	0.45	0.20	0.11	0.02	0.01	0.04
Adjusted R-squared	0.43	0.17	0.05	-0.04	-0.03	0.01
N	117	28	17	17	24	31

Source: Frontier analysis of EUIPO and OECD input-output data

*Note: T-statistics in parentheses, * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Robust standard errors.*

We then successively add in different IP measures (as per EQ4). While patent intensity does not alter the coefficient on TM, when copyright or design intensity measures are included, the coefficient on TM becomes insignificant (also when the joint IP measure is included). This may reflect correlation between the different IP variables. We therefore use principal components analysis[37] to distinguish a first component measuring a common effect (TM and non-TM IP moving together) from a second component isolating the distinct source (whether the source of IP intensity is due to TM versus non-TM IP). Here we see that an increase in general IP intensity (+1 standard deviation in component 1) is associated with export share 4 percentage points higher. The effect of whether the IP is due to TM or non-TM is insignificant. This would suggest that IP has an effect, but it does not matter whether it is TM or other IP that is contributing the IP intensity.[38]

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[36] With export share as dependent variable, Breusch-Pagan test confirms that robust standard errors are required. This is not the case when modelling value added per employee.

[37] PCA of TM intensity and patent intensity. First component has loading of 0.7 on each and eigenvalue of 1.58. Second component has loading of 0.7 on TM, -0.7 on patent and eigenvalue of 0.42.

[38] The following PCA models also yield similar results: TM and patent, TM and copyright, TM and design. In a PCA model with all four IP measures, only the first component (common IP effect) is significant.

Table 6   Exports model regression results with country dummies and multiple IP variables

MYS dummy	0.103	0.127	0.101	0.132	0.121	0.121
	(2.60)**	(3.07)***	(2.52)**	(2.98)***	(2.91)***	(2.91)***
PHL dummy	0.023	0.044	0.021	0.042	0.034	0.034
	(0.58)	(1.10)	(0.51)	(0.98)	(0.86)	(0.86)
SGP dummy	0.457	0.459	0.457	0.458	0.456	0.456
	(7.82)***	(8.09)***	(7.80)***	(7.68)***	(7.68)***	(7.68)***
THA dummy	0.124	0.144	0.122	0.144	0.134	0.134
	(2.85)***	(3.59)***	(2.89)***	(3.38)***	(3.16)***	(3.16)***
TM intensity	0.114	0.069	0.110	0.054	0.051	
	(2.54)**	(1.39)	(2.33)**	(1.10)	(0.91)	
Copyright intensity		0.101				
		(2.31)**				
Patent intensity			0.020			
			(0.29)			
Design intensity				0.124		
				(2.45)**		
Non-TM IP intensity					0.104	
					(2.06)**	
Principal component 1 (joint effect)						0.042
						(3.36)***
Principal component 2 (TM vs non-TM)						-0.016
						(0.62)
Constant	0.088	0.054	0.088	0.051	0.053	0.144
	(2.16)**	(1.31)	(2.15)**	(1.12)	(1.22)	(5.44)***
R-squared	0.45	0.48	0.45	0.49	0.47	0.47
Adjusted R-squared	0.43	0.45	0.42	0.46	0.45	0.45
N	117	117	117	117	117	117

Source: Frontier analysis of EUIPO and OECD input-output data

Note: T-statistics in parentheses, * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Robust standard errors.