



Discussion paper

Dissecting carry-along trade: what's in the bundle?

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Abstract

Replicating the delineation of carry-along trade (CAT) developed by [Bernard et al. \(2012\)](#) for the Netherlands, case studies at the firm-product-country level reveal that many sourced export products do not seem to be part of a joint bundle with core exports. We refine the concept of carry-along trade by considering the country dimension and the pervasiveness of product pairs to separate true carry-along trade from more incidental export transactions. The results indicate that one third of all exporting manufacturers enrich their product portfolio by engaging in CAT, accounting for approximately 20 percent of total goods exports. However, the persistence of CAT varies greatly across industries. The most common CAT-product turns out to be packing material. Regression analysis reveals that the productivity premium of CAT increases to a maximum of 10.8 percent for firms with a share of CAT in total exports of 42 percent beyond which it diminishes.

Keywords Exports, carry-along trade, bundling, firm heterogeneity
JEL-classification F23, F14, L25

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1 Introduction

International trade is dominated by a small number of large traders. For example, the top one percent of trading firms in the United States accounts for over 80 percent of total trade in terms of value (Bernard et al., 2007). These large traders are generally multi-product firms; only 12 percent of U.S. exporters dispatches more than five products to more than five countries, but these exports account for about 92 percent of total exports in terms of value. About 42 percent exports only one product, accounting for a mere 0.4 percent of total exports. These general notions are corroborated for a number of European countries by Mayer and Ottaviano (2008) and for the Netherlands by CBS (2009, 2011). These stylized facts illustrate the dominance of multi-product exporters in international trade. Bernard et al. (2012) show that the theoretical premise that these multi-product firms manufacture a given set of products and ship more than one of them abroad is too general. They show empirically that the majority of Belgian exporters ships products abroad that they do not manufacture using detailed micro-level trade and production data of Belgian firms. They coin this phenomenon *carry-along trade* (CAT), as exporters are "in effect carrying along products from unaffiliated producers to destination markets" (Bernard et al., 2012, p.38). Their results indicate that about 30 percent of the value of Belgian goods exports is exported by firms that did not produce these goods. About 90 percent of Belgian exporters exports goods they did not manufacture, indicating that carry-along trade is pervasive among exporters.

The existence of the phenomenon of carry-along trade and related concepts has since then been confirmed in a few other countries in addition to Belgium, such as Denmark (Abreha et al., 2013), Turkey (Lo Turco and Maggioni, 2013), Italy (Di Nino, 2015) and Slovenia (Damijan et al., 2013). The key takeaway from this small body of research is that the majority of exporters ships goods abroad that it does not manufacture itself, accounting for a considerable share of the value of total goods exports. The underlying business model that motivates firms to venture into carry-along trade is to generate additional value for its customers by bundling its own range of products with complementary products. Bernard et al. (2012) illustrate this principle by means of a coffee roaster supplying coffee systems business-to-business. The firm not only sells its own core product, roasted coffee, but also vending machines, coffee cups, sugar, milk, etc. This business model, product enrichment through the bundling of core products with complementary products, constitutes one example of carry-along trade. Other examples may be the bundling of core products with e.g. spare parts or merchandising,

provided these are manufactured by a supplier.¹

Starting from the premise that carry-along trade will most likely be pervasive in a small and export-oriented economy like the Netherlands we start by replicating the analysis of [Bernard et al. \(2012\)](#) for the Netherlands following the procedure laid out in the accompanying paper of [Van Beveren et al. \(2012\)](#). Then we proceed by elaborating on the empirical concept of carry-along trade. From a few case studies of individual industries we infer that a considerable number of exported products that are considered to be carry-along trade according to the concordance procedure of [Van Beveren et al. \(2012\)](#) actually seem to be unrelated to in-house produced exports. Or, put differently, export data at the firm-product-country level suggest that many sourced export products do not seem to be an element of a joint bundle with core exports. A good example of this would be the one-off sale of a second-hand tobacco processing machine to a firm located in a country to which the tobacco company does not export its tobacco products. Our research question follows naturally from this notion: can we refine the concept of carry-along trade in such a way as to filter out incidental export transactions that constitute no element of a carry-along trade type business model? We take up this question in two ways: (1) by introducing the country dimension in the equation in order to assess if the potential CAT-product is in fact shipped to a country to which the firm also exports its core products, and (2) by looking at the persistence of combinations of core and CAT export products in order to assess if a particular combination of products constitutes an element of a deliberate and sustainable business model. Our second research question builds on the first by investigating what characterizes the typical carry-along trader. Is carry-along trade concentrated in particular industries or among particular types of firms? How does carry-along trade align with re-exporting and importing behavior? How does an alternative delineation of carry-along trade affect the productivity patterns observed among CAT-exporters? Answering these questions gives us a flavor of what characterizes the typical carry-along trader and what sets it apart from regular exporters.

Our contribution to the literature is threefold. First, by replicating the analysis of [Bernard et al. \(2012\)](#) we add to the still small body of literature stressing the pervasiveness of carry-along trade among exporters, further challenging 'traditional' theoretical models of multi-product exporters.

¹Carry-along trade may also concern complementary services. For example, a manufacturer of food processing machines may bundle the delivery of a machine with services such as a training program for local staff, a maintenance program or a financial arrangement. As long as these services are provided by suppliers of the exporter they can be considered a form of carry-along trade. Since our data only concerns goods exports we will leave this matter for further research.

Second, we aim to further refine the concept of carry-along trade by attempting to isolate bundles of core products and complementary CAT-exports. In doing so, we attempt to separate true carry-along trade from incidental transactions and the export of goods that are not shipped as part of a bundle with core products. The underlying motivation for this is that it seems justified to consider only the pervasive exporting of sourced products paired with core products a sustainable carry-along trade type of business model, contrary to more incidental export transactions. Third, employing our alternative delineation of carry-along trade and confronting this with the dimensions of the exporter enables us to contribute to the development of a typology of the firms that engage in this type of exporting.

Our results indicate that one third of all exporting manufacturers in the sample enrich their product portfolio by exporting carry-along type products. The share of CAT in total goods exports in terms of value is approximately 20 percent and slightly rising over the years. However, the persistence of CAT varies greatly across industries. Nonetheless, these results show to be robust to the operationalization of the criteria to assess the sustainability of the underlying CAT-type business model. The most common product that manufacturing firms source and bundle with their core-products is packing material. Further regression analysis reveals a positive association between carry-along trading and productivity. Productivity shows to be increasing in the share of carry-along trade in total exports, but at a diminishing rate. Our findings suggest that this productivity premium increases to 10.8 percent for firms with a share of CAT in total exports of 42 percent. Beyond this point, the labor productivity premium of CAT-exporting is diminishing.

We proceed as follows. Section 2 introduces the micro-data sources employed in our analysis. Section 3 presents our empirical approach followed by a discussion of the results of this procedure in section 4 including a robustness test. Section 5 concludes.

2 Data

Our investigation of carry-along trade in the Netherlands is mainly derived from the combination of two data sources covering the years 2010 through 2016. We briefly introduce these two key data sources and two complementary data sources used in the analysis.

Trade data

The International Trade in Goods statistic (ITG) measures the value of goods involved in cross-border trade transactions by individual firms. Extra-EU trade is recorded by the Dutch Customs Authority. These data always include product information according to the Combined Nomenclature (CN) product classification and specification of origin and destination country. The Combined Nomenclature (CN) is developed to collect detailed and internationally harmonized data concerning goods trade and distinguishes, at the most detailed (8-digit) level, approximately 9,500 different product types. Intra-EU trade is recorded by the Dutch Tax Authority. Firms with intra-EU import and/or export values larger than a total of 1.2 million euro² are required to report their trade transactions in terms of product type and the origin or destination country through an additional questionnaire from Statistics Netherlands. Below this threshold firms are only required to report the total import and export value of intra-EU trade.³ Trade data available at the firm level cover more than 80 percent of annual aggregate trade in terms of value in the Netherlands.⁴ Export data concerns transactions involving a transfer of ownership, including what we refer to re-exports.⁵

Production data

The Prodcom is a survey-based statistic recording data concerning the physical production of goods and industrial services by firms in manufacturing sectors. All firms in NACE rev. 2 manufacturing sectors 10 through 33 with 20 or more employees are surveyed for the Prodcom statistic. These industries accounted for about 64,000 firms in the Netherlands in 2015, of which about 5,000 have 20 or more employees. For the purpose of our analysis we employ the annual value of production sold. Production is categorized using

²Threshold in 2016

³Through a combination of the ITG with VAT information taken from the Intra-Community Supply (ICS) statistic information regarding the destination of exports within the EU is also available for export values below the reporting threshold since 2013.

⁴Trade data are recorded on Value Added Tax registry numbers. Linking this information to the firm identification key used by Statistics Netherlands leads to a merging loss of about 20 percent of annual trade values, mainly on account of foreign firms trading on Dutch VAT registry numbers without any further presence in the Netherlands.

⁵Re-exports occur when economic ownership of goods is passed from residents to non-residents and the exported goods have been imported before being exported, after having received at most minor adaptations. In this respect we deviate only from [Bernard et al. \(2012\)](#) in terms of terminology. [Bernard et al. \(2012\)](#) who refer to re-exports as export transactions without a transfer of ownership, whereas this type of export transaction is generally referred to as transit trade in the statistics domain.

a dedicated product classification also coined the Prodcom. The Prodcom distinguishes between about 3,900 different products at the most detailed (8 digit) level.

The approximately 4,400 responding firms in the remaining 22 industries represent over 190 billion euros of industrial production. Over 80 percent of these firms also report goods exports, amounting to 103 billion euro. This constitutes 80 percent of total goods exports by firms in manufacturing sectors⁶, 34 percent of total goods trade by Dutch firms⁷ and 25 percent of total Dutch goods trade (see footnote 4).

Concording production and trade data

Research in the United States (Pierce and Schott, 2012a,b) and Belgium (Van Beveren et al., 2012) has resulted in a series of procedures generating product classifications which are consistent both through time and between trade and production. We follow the concordance procedure developed by Van Beveren et al. (2012) by confronting information about the production of goods from the Prodcom statistic with information about the exports of goods from the International Trade in Goods statistic and translate their concordance procedure to the Dutch case.⁸ The general idea of the procedure is to link individual products from both Prodcom and ITG to a third product classification, the Harmonized System (HS) at the 6-digit level, which can be considered intermediary to the Prodcom- and CN-classification. The procedure is developed in such a way that if one or more products in the first classification map to more than one product in the other these products are bundled in aggregated groups of products in a looping process. Van Beveren et al. (2012) coin the resulting alternative product classification HS6+. We refer to Van Beveren et al. (2012) for further technical details regarding the concordance procedure. The industry manufacture of coke and refined petroleum products (NACE Rev. 2 sector 19) is dropped from our analysis due to confidentiality issues. Repair and installation of machinery and equip-

⁶The remainder is on account of firms with less than 20 employees falling outside the scope of the Prodcom survey

⁷The remainder is mainly on account of wholesale traders who fall outside the scope of the Prodcom survey.

⁸Bernard et al. (2012) distinguishes between pure CAT exports and mixed CAT exports. We focus our analysis on pure CAT, refraining from identifying mixed CAT exports. This choice is mainly motivated by the fact that combining value information from different micro-data sources has shown to be a tricky endeavor, for example because of valuation issues. We mitigate this issue by only using value information from the trade statistics combining this with product information from the production statistics at the cost of not being able to identify mixed CAT exports.

ment (NACE Rev. 2 sector 33) is excluded because it mainly concerns the production of industrial services, which we are unable to connect with trade in goods.

The resulting harmonized data set contains about 4,000 firms in 2015. The loss of an additional 400 firms is on account of a group of firms that exclusively produces products that cannot be linked to goods trade, such as industrial services. After harmonizing trade and production the resulting data set from which the analysis is derived contains over 85 billion euro of goods exports. This constitutes about 28 percent of total goods exports of Dutch firms and 83 percent of goods exports by firms in manufacturing industries with 20 employees or more (the 'Prodcom-population'). It seems justified to assume that this provides a representative picture of production and trade by Dutch manufacturers.

In the final step in the data preparation process we link the harmonized data regarding production and trade with the Register of Business Demographics (RBD). The RBD is the backbone of the firm-level statistics process in the Netherlands and contains information about every firm in the Netherlands including a set of basic firm characteristics. These include for example firm size, age, multinationality and sector of activity. Finally, this linked micro-data is complemented with financial information taken from the Statistics of Finances of Enterprises and Baseline. These data sources contain information about e.g. turnover and intermediate inputs derived from tax declarations enabling us to calculate labor productivity in terms of value added per worker.

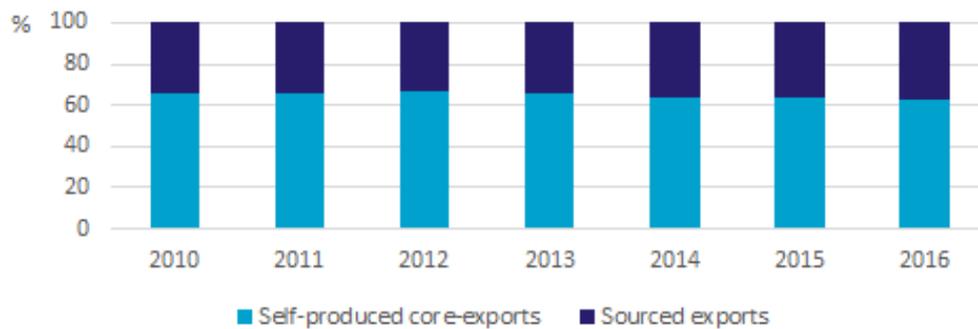
3 Empirical approach

Replicating the concordance procedure developed by [Van Beveren et al. \(2012\)](#) for the Netherlands yields results comparable to the findings for Belgium presented in [Bernard et al. \(2012\)](#). Figure 1 shows that approximately 35 percent of the value of goods exports by Dutch manufacturers is not produced by the exporting firm. This share of sourced exports increases gradually from 34 percent in 2010 to 37 percent in 2016; an increase of about 8 percent in 7 years. These findings seem to align nicely with a share of sourced exports of 30 percent found for a comparable economy such as Belgium in 2005 ([Bernard et al., 2012](#)), even though caution is due comparing these figures since we do not distinguish mixed CAT-exports in our analysis (see footnote 8).

However, a few case studies of particular industries reveal an additional layer of heterogeneity. The small and fairly homogenous tobacco industry

provides a good example. The majority (over 90 percent) of the exports of this industry consists of core products of the industry such as tobacco, cigarettes and cigars. Approximately 9 percent of the exports of this industry in terms of value could be considered carry-along trade with cigarette paper as the most prominent product of this kind. Cigarette paper, which is mainly produced by the paper industry, accounts for almost 5 percent of the export value of the tobacco industry. This points at a business model in which the tobacco manufacturer provides an additional service to its customers by bundling the exports of shag with cigarette paper. Some other examples of intuitively straightforward carry-along trade products of the tobacco industry include lighters, cigarette cases, matches and advertising materials. In addition, a number of CAT-products emerges that point at merchandizing, such as playing cards, clothing, agendas and pens.

Figure 1: Composition of Dutch exports replicating [Bernard et al. \(2012\)](#)



However, this case study also reveals that in many cases the exporting of goods the exporter did not produce concerns small or incidental transactions that do not necessarily fit into a carry-along trade type of business model. Examples of this include less surprising products such as machines for the processing of tobacco and parts of such machines, but also a wide range of less straightforward products such as agricultural machines and a range of chemical and oil products. It is not straightforward to consider these products to be carry-along trade, particularly because we observe many cases in which sourced exports are shipped to destination countries to which the tobacco manufacturer does not export its core products. A good example of this is the one-off exporting of a second-hand machine for the processing of tobacco

to a firm located in a country where the tobacco manufacturer has no regular business activities.

These findings are corroborated by a case study of the transport equipment industry. Sourced export products that fit straightforwardly in a carry-along trade type of business model include car seats, electronic measuring devices, fire extinguishers, oil filters and first-aid kits and merchandizing gear such as clothing, model cars and calendars. However, again we observe a range of sourced export products that are difficult to reconcile with the concept of carry-along trade, such as water purifiers, crystal objects and paper and cardboard.

The general conclusion that we draw from these case studies is that Dutch manufacturers also export products that they have not produced themselves on a considerable scale, just as existing research in a number of other small open economies has already shown. However, we also ascertain that many of the observed patterns in the export of sourced products are difficult to reconcile with the concept of carry-along trade, for example because of the incidental character of the export transaction or the fact the sourced exports are frequently not bundled with core products of the firm. This notion provides us with the motivation for our research question: can we refine the concept of carry-along trade in such a way as to filter out incidental export transactions that constitute no element of a carry-along trade type business model?

We take up this question in two ways: (1) by introducing the country dimension in the equation in order to assess if the supposed CAT-product is in fact shipped to a country to which the firm also exports its core products, and (2) by looking at the persistence of combinations of core and CAT export products in order to assess if a particular combination of products constitutes an element of a sustainable business model. We develop a set of decision rules enabling us to determine of each export product of each individual industrial exporter in each year if it concerns:

1. Self-produced core-exports, includes all core products manufactured by firms in a specific 2-digit NACE-industry. This implies that any product a firm manufactures itself belongs to its core-export;
2. Carry-along trade, includes products that the firm did not produce itself, but which it bundles with its core-exports, adding value for its customers as part of a sustainable business model;
3. Core-related non-CAT, includes core products that the firm did not produce itself and therefore qualify as potential CAT, but ultimately

disqualify, for example because they are exported to a destination that the firm does not serve with its self-produced product range;

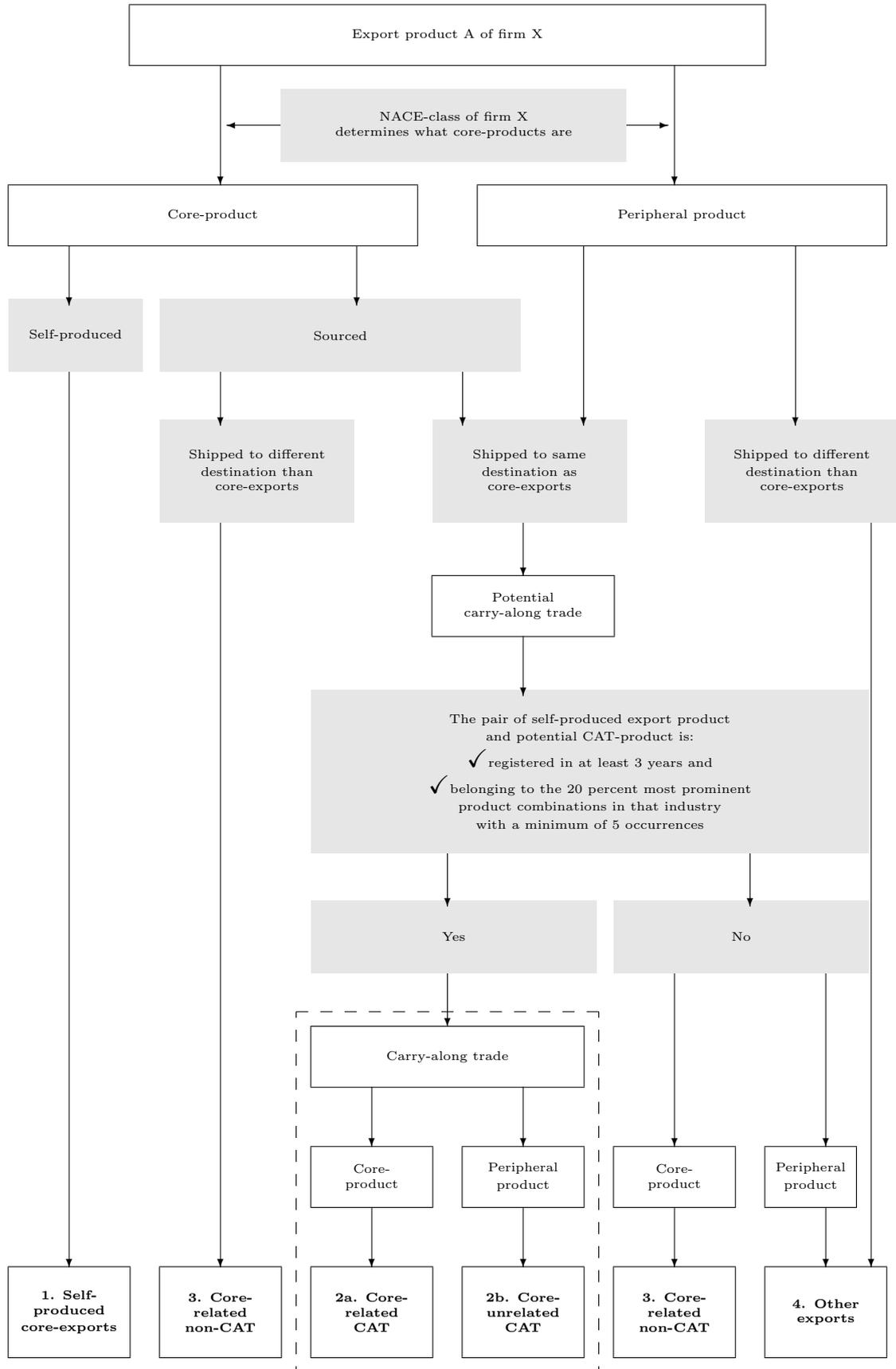
4. Other exports, includes products that do not belong to either one of the three categories above. For example peripheral products that are shipped to destinations where the firms does not sell its core-exports.

The decision tree to determine in which of these categories a particular export product of an individual firm resorts is depicted in Figure 2. We consider export product A of firm X. The 2-digit NACE-class in which firm X resides determines what is considered a core-product and what is a peripheral product, irrespective of whether the firm manufactured the product. In the next step we determine, using firm-level production data, if the core-product is self-produced or sourced. In case of the former, the product is classified as self-produced core-exports (group 1 at the bottom of Figure 2). In case of the latter, we determine, using the geographical information in the trade data, if the sourced product is bundled with core exports and shipped to the same destination country. If that is not the case - the sourced products are shipped to a destination not served with core-exports by the firm - the product is classified as core-related non-CAT (group 3), because it is not part of a product bundle including core-exports. An example of this would be a tobacco manufacturer, producing cigarettes and shipping them only to Germany, sourcing cigars and shipping those to France. The same assessment is made for peripheral products. These products are classified as other exports (group 4) if they are exported to a destination to which the firm does not ship core-exports. Extending the previous example this would be the tobacco manufacturer exporting, for example, cardboard to France.

The sourced core-products and peripheral products that are shipped to the same destination country as the self-produced core-exports of the firm are potentially carry-along trade. However, to be ultimately classified as carry-along trade, the bundle of exported products should be derived from a sustainable business model derived from the principle of product enrichment through bundling, rather than being an occasional and possibly coincidental combination of self-produced and sourced export products. In order to make this assessment we formulate two additional criteria for sourced products to be classified as CAT-exports. The pair of self-produced export product and potential carry-along trade product is:

- observed in that particular industry in at least three of the seven years considered in our analysis, and;
- belonging to the 20 percent most prominent product combinations (in

Figure 2: Typology of carry-along trade: decision tree



terms of observed combinations rather than in terms of export value) in that particular industry with a minimum of 5 occurrences.

In case the sourced export product meets these two criteria, in addition to being shipped in a bundle with self-produced core-exports to the same destination, there is reason to assume that it is part of a viable business model of firm X and hence could be classified as carry-along trade. Within the set of CAT-products we additionally distinguish between products belonging to the core of the relevant industry (group 2a) and products that are peripheral to the industry (group 2b). Building on our example of the tobacco manufacturer the former would mean that the tobacco company bundles its self-produced cigarettes with a product variety that it does not produce, enabling the firm to expand the core-product range it offers to its customers. An example of the latter would be de tobacco manufacturer pairing the export of shag with cigarette paper sourced from the paper industry.

In the next section we present the results of the procedure proposed in this section. We present a number of key figures of carry-along trade by Dutch industrial exporters and the characteristics of firms engaging in this type of export activity. In addition to this, we provide an analysis of the robustness of our decision tree to the choices made, particular with respect to the criteria concerning the persistence of pairs of self-produced core-exports and potential CAT-products.

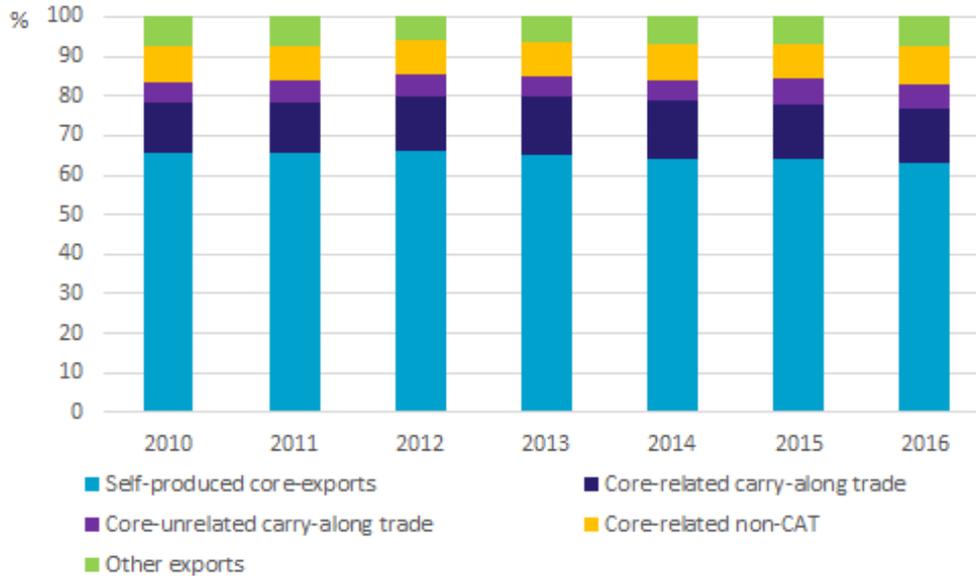
4 Results

Composition of exports

Figure 3 decomposes the sourced exports from Figure 1 in the three categories introduced in the previous section: (1) carry-along trade, (2) core-related non-CAT and (3) other exports. Straightforwardly, the share of self-produced core-exports is remains the same at about 65 percent. The remaining 35 percent is constituted mainly of core-related CAT; approximately 13-14 percent of the value of goods exports consists of varieties of the core products of the industry that the firm does not produce itself, thus expanding the core product range offered by the exporter. An additional 5-6 percent is formed by CAT-products that do not belong to the core of the industry, thus enriching the self-produced core products offered by the exporter. Approximately 9 percent of the total value of goods exports is classified as core-related non-CAT, for example because the sourced exports are not shipped to the same destination in a bundle with self-produced core-exports. Other exports, characterized by a more coincidental nature, make up 6-7 percent of total goods

exports of industrial manufacturers.

Figure 3: Composition of Dutch goods exports



The break-down of goods exports in different categories does not vary dramatically over time. However, the share of self-produced core-exports seems to decrease slightly over the years. This decrease is mainly on account of the share of carry-along trade in total exports which increases from about 18 percent in 2010 to 20 percent in 2016, a growth of about 13 percent. Contrary to the share of CAT in total exports, the share of firms engaging in CAT does not show an upward trend. It has been more or less stable at about 35 percent in recent years. This considerably less than the 87 percent pure CAT exporters reported by [Bernard et al. \(2012\)](#) for Belgium. However, it seems intuitive that our refined definition of carry-along trade affects the share of involved exporters more dramatically than the share of exports in terms of value. Indeed, about 70 percent of the exporters in our sample exports at least one sourced product (either CAT or non-CAT), a finding much more in line with the Belgian figures. Still, about one third of goods exporters in manufacturing sectors engage in carry-along trade, indicating that this is a persistent and viable business strategy among Dutch exporters. The variation between industries is considerable though (Figure 4), ranging from over 60 percent in the chemical and pharmaceutical industry to just under 20 percent in wood, paper and printing. In addition, the large majority (80 percent) of firms engaging in CAT bundles at least one imported (and

re-exported) product with their core-products.

Figure 4: Persistence of CAT by manufacturing industry

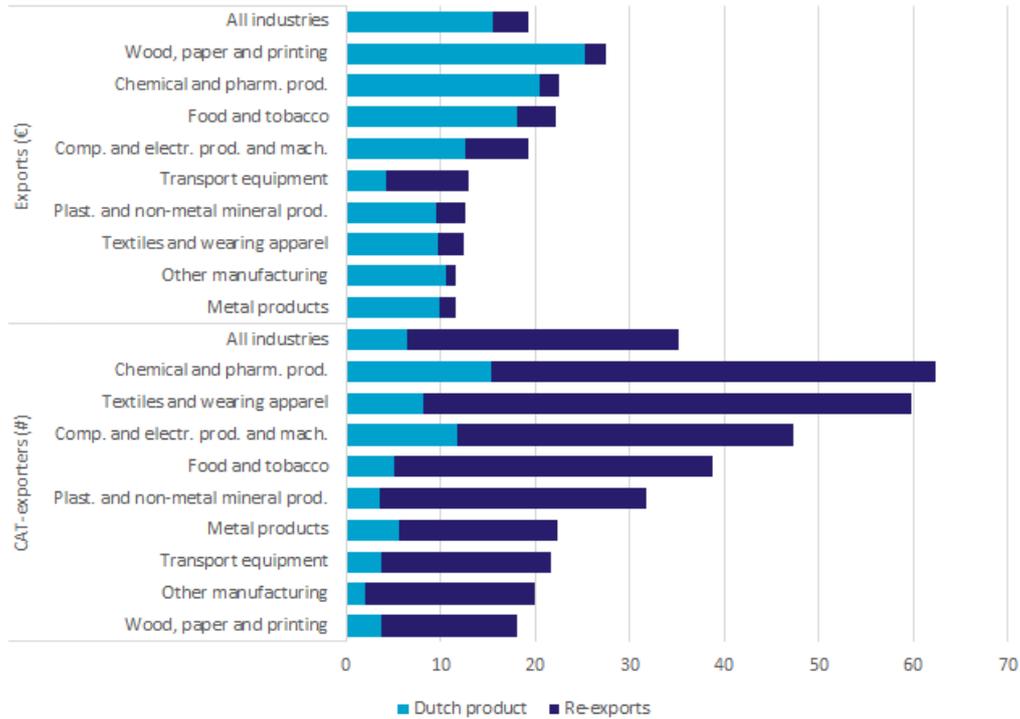
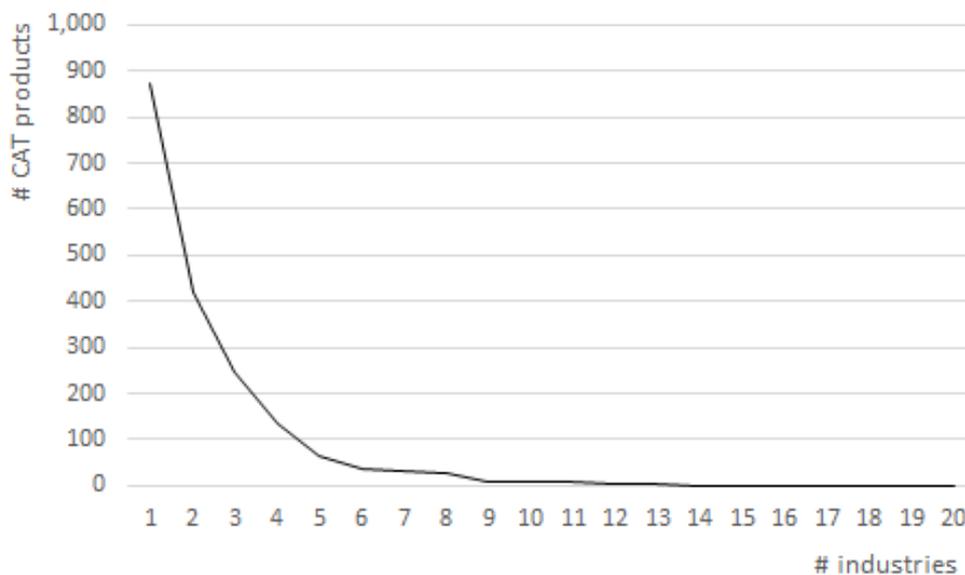


Figure 4 reveals that the share of CAT in total exports varies considerably by industry, ranging from almost 30 percent in the wood, paper and printing industry to just over 10 percent in the metal industry. The prominence of CAT in wood, paper and printing is largely on account of a small number of large printing companies combined with the fact that printing is de facto a service implying that e.g. the materials used in the printing process such as paper are sourced. In addition to this, the importance of re-exports as a source for carry-along trade also shows considerable heterogeneity across industries. The transport equipment industry stands out in this respect, two thirds of the value of carry-along trade is imported and re-exported. This reflects the fact that the manufacturing of transport equipment is an example of a highly fragmented and international production chain. This also holds, albeit to a lesser extent, for the manufacturing of computers, electronic products and machinery.

CAT export products

Core-products of a particular industry are the carry-along trade products of firms in the same or in a different industry and vice versa. Figure 5 reveals that about 900 different export products are a CAT-element of the export bundle of just a single industry. This rapidly decreases to a single export product that is bundled with the self-produced core-exports of 20 different industries. Unsurprisingly, this CAT-product concerns packing materials such as cardboard boxes. This most common CAT-export product constitutes almost 3 percent of the total value of CAT-exports. Beer brewers are a good example of an industry exporting packing materials - such as beer cans, bottles and kegs - as carry-along trade. The fact that packing materials are such a common CAT-product makes sense intuitively, since the manufacturing of packaging is generally outsourced to specialized manufacturers and the packaging of a product is usually tailor-made in terms of design and production. In that sense, packing materials are an atypical CAT-product since they are usually not sold separately. However, from a marketing perspective they do enrich the proposition of the core-product and can as such be considered a CAT-product.

Figure 5: CAT-products by the number of industries supplying it as CAT (2015)



Further anecdotal evidence provides an informative picture of the various

other business models underlying carry-along trade. For example, manufacturers of electric razors enrich their export proposition by bundling their appliances with brushes, hair dryers, additional razor blades, but also cosmetics such as aftershave. The same business model, bundling self-produced core-exports with complementary products, is observed among manufacturers of loudspeakers bundling their core-products with e.g. amplifiers, microphones and in-ear headphones. Spare parts are also frequently bundled with core-products. Examples of this are electric engines 'carried-along' with food processing machines and manufacturers of furniture bundling their products with spare hinges, locks, feet or wheels. Merchandising is a common form of carry-along trade as well, for example observed among beer brewers pairing the export of their core-product, beer, with calendars, playing cards, t-shirts and sunglasses.

Carry-along trade and productivity

In the final step of our empirical analysis we investigate to what extent carry-along trade is associated with firm-level productivity. It makes sense intuitively to expect that only the more productive firms are able to engage in carry-along trade, since CAT-exporters most likely need to sustain a considerably larger network of suppliers and distributors than traditional exporters in order to be able to provide their buyers with their core-products paired with CAT. In order to investigate this we estimate a basic OLS-model with standard errors clustered at the firm-level. The regression specification is presented in equation 1. Labor productivity ($LabProd_{it}$) is our dependent variable measured as (the log of) value added per worker. (CAT_{it}) is our explanatory variable of interest and is operationalized in three ways: (1) as a dummy variable with value 1 if the firm engages in carry-along trade, (2) as the share of carry-along trade in total exports and its squared value and (3) as share of CAT-products in the total number of exported products and its squared value. The latter two measures provide an indication of the intensity of carry-along trade, or its importance as an export strategy to the individual firm. We include quadratic terms for these measures since we expect their relationship with productivity to be non-linear; it seems intuitive to expect a certain maximum to the share of CAT in total exports that is sustainable.

$$\begin{aligned} \ln LabProd_{it} = & \alpha + \beta_1 CAT_{it} + \beta_2 size_{it} + \beta_3 ForMNC_{it} + \beta_4 DomMNC_{it} + \\ & \beta_5 FastGr_{it} + \beta_6 Age_{it} + \beta_7 Industry_i + \beta_8 Year_t + \epsilon_{it} \end{aligned} \quad (1)$$

In addition to industry and year fixed effects we control for a number of firm characteristics; firm size ($size_{it}$) measured as the number of workers,

a dummy variable with value 1 for multinationals with the parent company located abroad ($ForMNC_{it}$), a dummy variable with value 1 for domestic multinationals ($DomMNC_{it}$), a dummy variable with value 1 for fast growing firms in terms of employment ($FastGr_{it}$) and a dummy variable with value 1 for firms aged 10 years or older (Age_{it}).⁹ The subscript i identifies the individual firm and t indexes the year. The error term is denoted ϵ_{it} .

The regression results are presented in Table 1. We estimate 3 different models in which only our measure of carry-along trade varies. All regressions consistently point at a positive association between carry-along trading and productivity. The first model employing a dummy variable with value 1 for CAT-exporters indicates that carry-along trade is, as hypothesized, positively associated with firm-level productivity. Of the control variables only the dummy variables controlling for multinationality of the firm are significant and both positively associated with productivity, a common finding in empirical studies of firm heterogeneity. It might seem surprising in this respect that firm size is not significantly tied to productivity in our analysis. This might however be on account of the fact that our analysis only concerns larger firms, which highly reduces the variation in terms of firm size that is common in this type of empirical research.

The second regression model shows that productivity is increasing in the share of carry-along trade in total exports, but at a diminishing rate given the significantly negative coefficient of the squared value. Our findings suggest that a firm with a share of CAT in total exports of 10 percent has a 4.4 percent higher labor productivity than an identical firm not engaging in CAT-exporting. This productivity premium increases to 10.8 percent for firms with a share of CAT in total exports of 42 percent. Beyond this point, the labor productivity premium of CAT-exporting is diminishing. Similar patterns are observed in model 3 in which the share of CAT-products in the total number of export products serves as a measure of CAT-intensity.

⁹A firm is considered fast growing if its workforce has been growing with at least 10 percent annually for at least 3 subsequent years.

Table 1: Labor productivity premia of Dutch CAT-exporters (pooled OLS, 2010-2016)

	(1)	(2)	(3)
<i>CAT-exports</i>			
Dummy variable	0.073*** (5.16)		
Share in total value		0.486*** (4.55)	
Share in total value (squared)		-0.577*** (-3.9)	
Share in total # products			0.405*** (4.41)
Share in total # products (squared)			-0.565*** (-3.74)
<i>control variables</i>			
Employment (ln)	0.008 (0.73)	0.011 (1.00)	0.012 (1.02)
Foreign multinational (dummy variable)	0.226*** (10.62)	0.230*** (10.87)	0.231*** (10.89)
Dutch multinational (dummy variable)	0.061*** (3.63)	0.064*** (3.79)	0.064*** (3.8)
Fast growing firm (dummy variable)	0.016 (0.84)	0.018 (0.92)	0.016 (0.82)
Mature firm (dummy variable)	-0.006 (-0.3)	-0.004 (-0.18)	-0.004 (-0.21)
Industry fixed effects	yes	yes	yes
Year fixed effects	yes	yes	yes
<i>No. of observations</i>	18,519	18,519	18,519
<i>adj. R²</i>	0.133	0.132	0.132

Notes: Standard errors are clustered at the firm-level. *t* statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robustness test

The criteria we employ to assess to what extent the pair of self-produced core-product and potential CAT-product are part of a deliberate export strategy are of course debatable. An iterative process, aimed at distinguishing 'true' CAT from more coincidental and random combinations of export products, resulted in the requirements that the product pair needs to be observed in

that industry in at least three of the seven years considered and belong to the 20 percent most prominent product pairs in that particular industry. Table 2 shows how the composition of the total export value, and particularly the division between CAT and non-CAT exports, is affected when these requirements are modified. The results show that the share of carry-along trade in total exports is reassuringly stable to the operationalization of the criteria to assess the sustainability of the underlying business model. The share of CAT is only slightly lower when we restrict CAT to the 10 percent most prominent product combinations and does not increase when we relax this requirement. In addition, the share of CAT exports also seems to be robust to extending or limiting the number of years the product pair needs to be observed. In other words, changing the parameters of our algorithm would not lead to a composition of exports that differs notably from the picture emerging from Figure 3. Paired with the anecdotal evidence presented in this section this indicates that our decision seems to enable us to effectively distinguish true CAT from coincidental product combinations.

Table 2: Robustness of our delineation of CAT

Observed	Most prominent	1. Self-produced core-exports	2a. Core-related CAT	2b. Core-unrelated CAT	3. Core-related non-CAT	4. Other exports
3 yrs	20%	64.8	13.7	5.6	9.1	6.8
3 yrs	40%	64.8	13.7	5.6	9.0	6.8
3 yrs	30%	64.8	13.7	5.6	9.0	6.8
3 yrs	10%	64.8	12.3	5.1	10.5	7.3
3 yrs	20%	64.8	13.7	5.6	9.1	6.8
2 yrs	20%	64.8	13.8	5.6	9.0	6.8
4 yrs	20%	64.8	13.3	5.5	9.4	6.9
5 yrs	20%	64.8	12.9	5.3	9.8	7.1

5 Conclusion and discussion

Concording firm-level export and production data in the spirit of [Van Beveren et al. \(2012\)](#) we dig into the specifics of carry-along trade in Netherlands. In addition to replicating the exercise of [Bernard et al. \(2012\)](#); [Van Beveren et al. \(2012\)](#) for the Netherlands, with qualitatively comparable results, we proceed to try to refine the concept of carry-along trade in such a way as to separate true carry-along trade from incidental transactions and the export of goods that are not shipped as part of a bundle with core products. The motivation for this endeavor lies in the results of a few case studies of individual industries at the firm-product-country level revealing that many sourced export products do not seem to be an element of a joint bundle with core

exports. This observation seems to justify the choice to consider only the pervasive exporting of sourced products paired with core products a sustainable carry-along trade type of business model, contrary to more incidental export transactions. From this notion we proceed first by introducing the country dimension in order to assess if the supposed CAT-product is in fact shipped to a country to which the firm also exports its core products. In addition to this we investigate the persistence of combinations of core and CAT export products in order to assess if a particular combination of products constitutes an element of a sustainable business model. The resulting set of decision rules enables us to determine of each export product of each individual industrial exporter in each year if it concerns self-produced core-exports, carry-along trade (either related or unrelated to the firms core-business), core-related non-CAT or other exports.

The results from the process of refining the delineation of carry-along trade shows that one third of all exporting manufacturers in the sample enrich their product portfolio by exporting carry-along type products. The share of CAT in total goods exports in terms of value ranges from 18 to 20 percent and is slightly rising over the years. However, the persistence of CAT varies greatly across industries. For example, the transport equipment industry stands out with respect to the importance of re-exports, two thirds of the value of carry-along trade is imported and re-exported. This reflects the fact that the manufacturing of transport equipment is an example of a highly fragmented and international production chain. Generally, these results show to be robust to the operationalization of the criteria to assess the sustainability of the underlying CAT-type business model.

There is one single export product that is bundled with the self-produced core-exports of more or less every industry: packing materials such as cardboard boxes, cans or bottles. This most common CAT-export product constitutes almost 3 percent of the total value of CAT-exports. The fact that packing materials are such a common CAT-product makes sense intuitively, since the manufacturing of packaging is generally outsourced to specialized manufacturers and the packaging of a product is usually tailor-made in terms of design and production. Even though packaging is usually not sold separately, it does enrich the the proposition of the core-product from a marketing perspective and can as such be considered a CAT-product. Further examples of typical carry-along trade include manufacturers of electric razors enriching their export proposition by bundling their appliances with complementary products such as spare parts, brushes and cosmetics such as aftershave. Merchandising shows to be a common form of carry-along trade in general as well.

Basic regression analysis reveals a positive relationship between carry-

along trading and productivity. Productivity shows to be increasing in the share of carry-along trade in total exports, but at a diminishing rate. Our findings suggest that this productivity premium increases to 10.8 percent for firms with a share of CAT in total exports of 42 percent. Beyond this point, the labor productivity premium of CAT-exporting is diminishing. Similar patterns are observed when we consider the share of CAT-products in the total number of export products as a measure of CAT-intensity.

Some avenues for further research follow from the limitations of our study. First of all, our analysis only concerns goods exports. It would be interesting to investigate carry-along trade in a framework comprising of both goods and services trade. Anecdotal evidence reveals for example that the export of food processing machines is frequently accompanied with a contract concerning training of local machine operators and maintenance of the machinery. In addition to this, financial constructions such as the financial leasing of capital goods is also a common phenomenon. To the extent that exporters outsource the provision of these additional services to a supplier this would constitute a currently unobserved form of carry-along trade. It would be interesting to investigate to what extent exporters have adopted CAT exporting strategies consisting of a combination of goods and services. However, at this point, the level of detail in the micro-data concerning services trade is unfortunately insufficient to tackle this issue yet.

Second, we consider the firm-product-country dimension in our delineation of carry-along trade. An additional dimension that is not considered in our decision tree is the buyer. Revisiting our previous example of the tobacco industry, it would be possible that the shag and the cigarette paper are sold to different buyers in the same country. Strictly speaking this would mean that the tobacco manufacturer is not enriching its self-produced core-exports (shag) by bundling it with carry-along trade (cigarette paper). This dimension is currently unobserved. Within certain limits it would most likely be possible to dig into this issue using for example the intra-community supply information from VAT-registers. Ignoring the buyer dimension in the delineation of carry-along trade implies that the size of this phenomenon could be overstated. However, the empirical evidence presented in this paper does not give rise to the suspicion that this is a serious threat.

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Explanation of figures

Empty cell	Figure not applicable
.	Figure is unknown, insufficiently reliable or confidential
*	Provisional figure
**	Revised provisional figure
2018–2019	2018 to 2019 inclusive
2018/2019	Average for 2018 to 2019 inclusive
2018/'19	Crop year, financial year, school year, etc., beginning in 2018 and ending in 2019
2016/'17–2018/'19	Crop year, financial year, etc., 2016/'17 to 2018/'19 inclusive

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