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ONLINE APPENDIX ¹

Section 1. Cross-Industry Additional Analysis

This section reports the additional analysis that we performed to show that our key finding—according to which the domestic content of exports as a share of total exports (also known as VAX ratio) is lower for foreign-controlled affiliates than domestically-controlled firms—can be identified across the different industries considered in our application. As expected, there are variations in the VAX ratio observed in each industry as evidenced by the figures reported in Table OA1—from the lowest average in Coke & petroleum (38% for domestic-controlled firms and 18% for foreign-controlled affiliates) to the highest in IT services (86% for domestic-controlled firms and 80% for foreign-controlled affiliates). However, overall our results illustrate that for each industry the average VAX ratio is lower for foreign-controlled affiliates than for domestically-controlled firms. Thus, our findings show evidence that the effect identified through our illustrative application is not industry-specific, but a more general one that goes beyond the specificities of a given industry.

¹ Abbreviations used in this Online Appendix, in alphabetical order: GVC = Global Value Chain; IO = Input-Output; OECD = Organisation for Economic Cooperation and Development; TEC = Trade by Enterprise Characteristics (database); VAT = Value Added Tax.

Table OA1 – Average and Range of Domestic Content of Exports as a Share of Total Exports (also known as VAX Ratio) by Industry, for all Countries Included in this Study ^{1,2}

Industry	Domestic-controlled firms			Foreign-controlled affiliates		
	Average	Minimum	Maximum	Average	Minimum	Maximum
Basic metals	57.50%	17.90%	77.10%	50.40%	15.50%	71.00%
Chemicals	61.70%	41.30%	77.10%	56.50%	0.00%	89.40%
Coke & petroleum	38.80%	2.90%	74.70%	18.10%	0.00%	54.70%
Construction	74.80%	56.50%	85.00%	61.40%	39.10%	76.70%
Electrical machinery	64.00%	49.10%	76.30%	56.90%	37.50%	70.30%
Fabricated metals	69.90%	55.00%	82.50%	52.60%	38.50%	67.00%
Food products	70.00%	56.30%	78.40%	62.80%	42.60%	73.60%
Hotels & restaurants	79.90%	61.70%	87.80%	71.30%	49.80%	84.50%
ICT & electronics	65.50%	39.50%	82.00%	53.20%	28.00%	77.80%
IT services	86.10%	54.20%	94.60%	79.50%	40.50%	89.30%
Machinery	67.50%	39.50%	77.90%	59.40%	44.60%	68.90%
Mining	75.90%	60.30%	94.50%	68.80%	38.80%	95.60%
Motor vehicles	60.30%	50.70%	75.00%	50.40%	35.80%	74.30%
Non-metallic minerals	70.30%	47.70%	78.80%	61.30%	30.40%	76.50%
Other business services	86.00%	73.50%	95.70%	73.30%	23.70%	84.00%
Other manufacturing	68.90%	47.50%	83.20%	54.00%	16.10%	70.30%
Other transport	61.80%	36.60%	83.60%	55.60%	24.70%	79.40%
Paper, print & publishing	74.10%	57.90%	84.70%	65.10%	40.10%	75.70%
Post & telecoms	83.70%	59.70%	92.10%	77.20%	61.70%	87.10%
Real estate	81.00%	30.00%	96.60%	75.40%	3.50%	97.60%
Renting of machinery	85.70%	61.40%	96.40%	74.20%	22.30%	90.60%
Rubber & plastics	64.80%	41.50%	81.90%	58.80%	47.00%	80.50%
Textiles & apparel	64.80%	50.70%	75.80%	59.70%	36.80%	74.20%
Transport & storage	79.50%	58.50%	91.40%	65.80%	43.40%	77.70%
Utilities	68.80%	43.90%	85.00%	60.60%	31.90%	86.80%
Wholesale & retail	85.40%	63.10%	91.80%	77.00%	61.00%	85.50%
Wood	71.70%	46.40%	80.50%	61.00%	40.70%	77.60%

¹ Agriculture, Finance and Insurance, Public Administration., Education, Health, Other services, and Private household sectors are excluded from this table. For Agriculture, TEC export shares are used as proxies for value added and gross outputs, and the VAX ratio would simply reflect this assumption. We did not further split by firm ownership the Public Administration, Education, Health, Other services, and Private household sectors as foreign-controlled affiliates count for only a little share. Finance and Insurance is also not split given its distinctive nature—the estimates using TEC statistics would not be suitable. For more details about quantity of the data and imputation methods, refer to Sections 2 and 3 in the Appendix.

² Zero shares in this indicator are consequence of the minimum corrections applied to the data.

Section 2. Robustness Checks

While the findings presented in this study provide interesting insights on the role of domestically-controlled and foreign-controlled firms in GVCs, the fact that these have been derived from extended IO

tables that were generated on the basis of multiple assumptions raises questions regarding their robustness. As discussed above, three key assumptions have been made in order to apply the methodology elucidated in Section 1 of the Appendix. The first key assumption is *no substitution effects* between imports and domestically purchased products by domestically-controlled and foreign-controlled firms (i.e., while the share of imports in purchases differs across firms, the product baskets in imports and in domestic purchases do not). The second key assumption is *no use preference* in the sense that the production of domestically-controlled and foreign-controlled firms is proportionally attributed to intermediate and final demand (excluding exports). The third key assumption is *no supplier preference* in that firms have no preference to purchase from either domestically-controlled or foreign-controlled firms. The aim of this Section 2 is to test the sensitivity of the results obtained to the second and third assumptions and thus discuss the robustness of our findings.²

Instead of using proportionality assumptions, extremes are explored. Combinations of maximum and minimum assumptions result in several alternative extended IO tables by firm type; and consequently, different estimates for TiVA indicators. Comparing the results for all possible scenarios for key TiVA indicators by firm characteristics, such as import content of exports and the direct and indirect exports of value added gives insights into how sensitive the findings presented in the research note are to changes in the assumptions made by providing broad upper and lower bounds.

The *no use preference* assumption modified, and simulated below, relates to the distribution of output across intermediate and final use categories. The proportionality assumption implies that foreign-controlled affiliates have the exact same sales structure as smaller ones. However, it may be that within the same industry, foreign-controlled affiliates are more successful at supplying final consumers and domestically-controlled firms are mainly involved as upstream suppliers to other firms, or vice versa. In

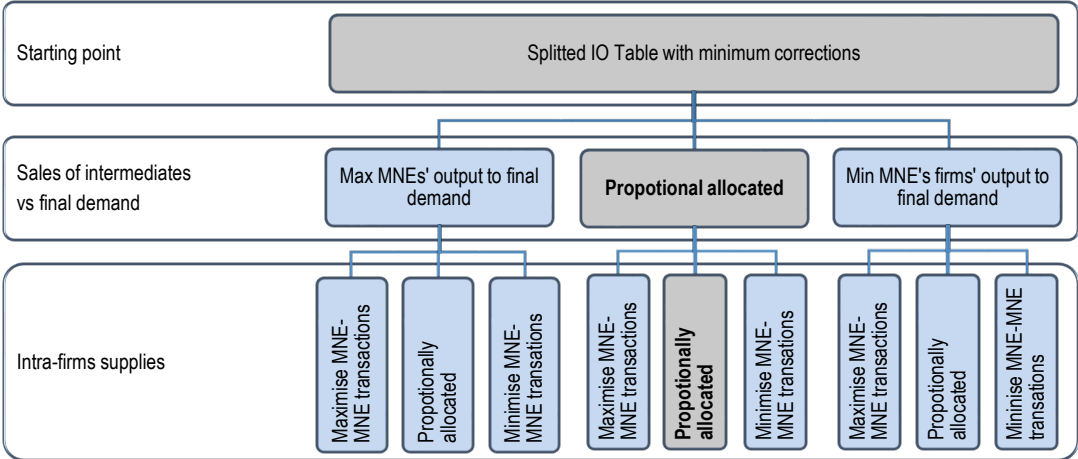
² We designed the robustness checks to only target the latter two proportionality assumptions, namely *no use preference* and *no supplier preference*. Setting *no substitute effect* loose would not change firms' total import use as a constraint, as it only alters which foreign industry has provided upstream value-added inputs. Therefore, this assumption would not change the key indicators, such as the decomposition of domestic and foreign value-added content of exports. Hence our decision to focus on the second and third assumptions in our robustness checks.

the robustness tests below, values for each scenario were determined by either maximizing foreign-controlled affiliates' sales for intermediate use (and minimising the share for final use), and vice versa.

The modification of the *no supplier preference* assumption introduced variation in the supplier bias. The proportionality assumption implies that neither domestically-controlled nor foreign-controlled firms have a preference for purchasing from other domestically-controlled or foreign-controlled firms. While high-quality statistical information about these relationships would represent a 'holy grail' in the creation of (heterogeneous) IO tables, this would typically only be possible to obtain via detailed surveys, or for example VAT declarations that included VAT counterpart information. In the two extreme cases that we tested, foreign-controlled affiliates' purchases from other foreign-controlled affiliates were either maximized or minimized (again within the constraints provided by the row and column totals of the extended IO tables), which in parallel minimizes or maximizes domestically-controlled firms' inputs from foreign-controlled affiliates.

Combining the two modifications above with the proportionality assumption results in 9 different scenarios to generate an extended IO table, as depicted in Figure OA1. The results presented in the research note form the 'middle' scenario are highlighted in grey.

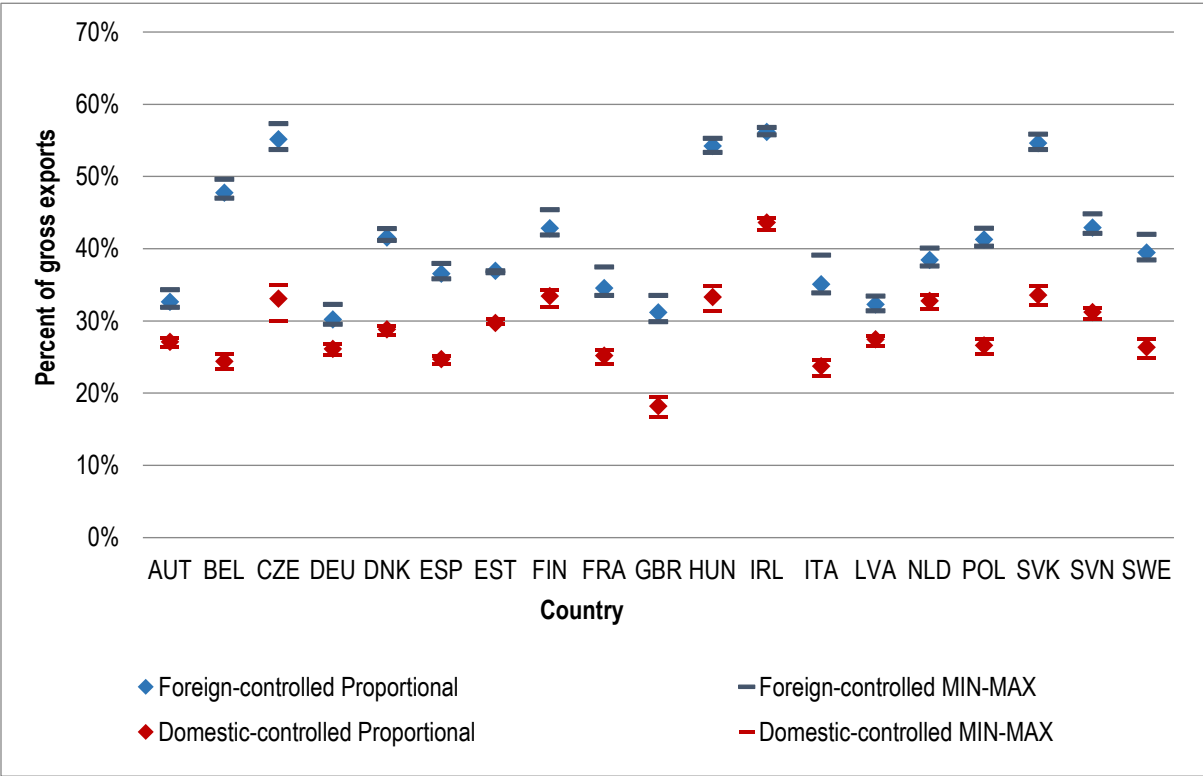
Figure OA1. Robustness Tests: Overview of the 9 Scenarios ^a



^a The results reported in the article follow the middle, grey-shaded option

Calculating the import content of exports under each of these scenarios, Figure OA2 highlights the ‘mid-point’ estimates as presented in the research, as well as minimum and maximum values calculated based on the simulations for the other eight scenarios for total economy. At this level of aggregation, the results are not very sensitive to the proportionality assumptions used, and certainly not for the main conclusion that foreign-controlled affiliates have a higher foreign value added content of exports compared to domestically-controlled firms. The largest differences occurred for France, Turkey, and Mexico, with up to 5 percentage point variation in the estimates. Even for these countries for which differences are largest, these stimulated boundaries associated with foreign value added content of exports are thus unlikely to change the key findings discussed in the note.

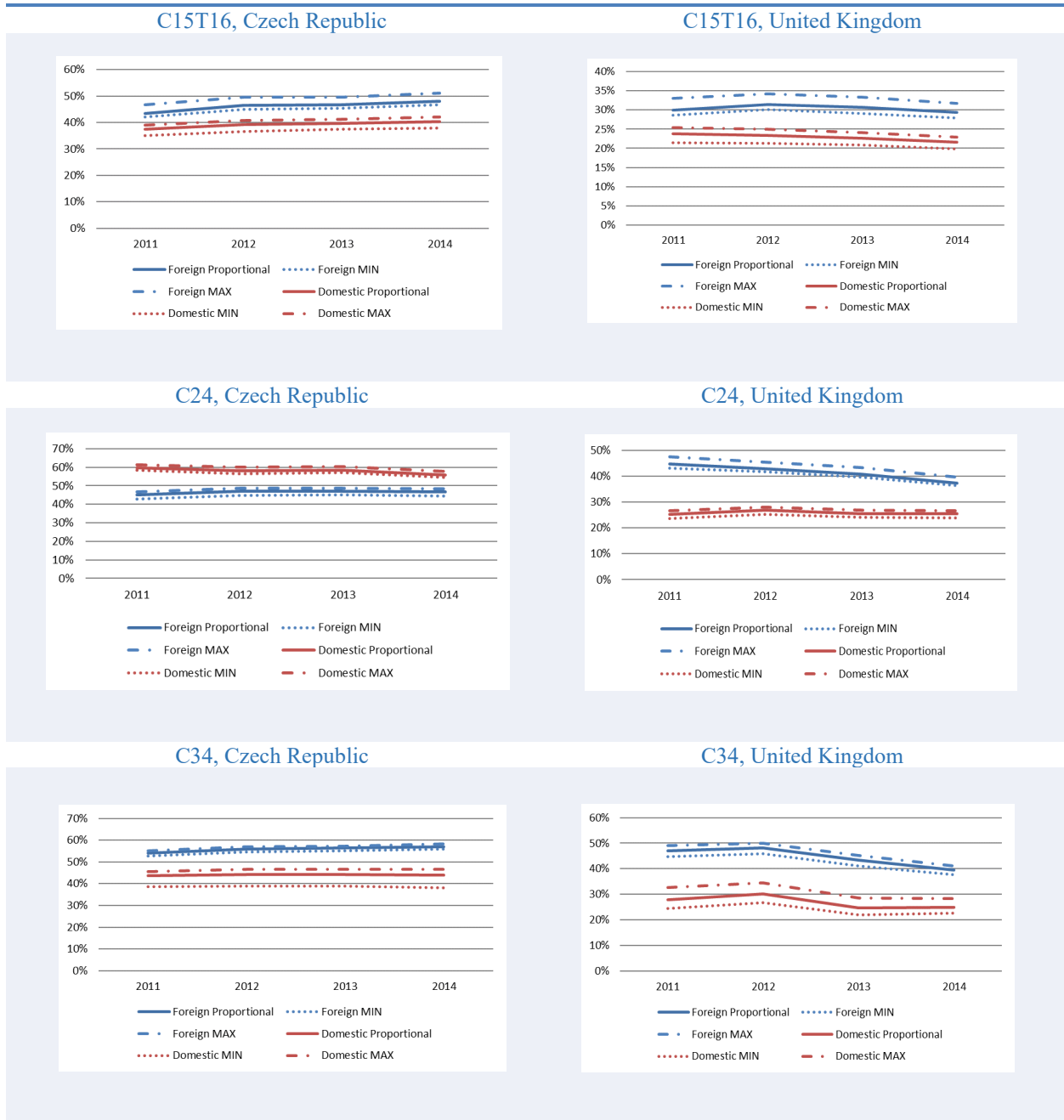
Figure OA2. Mid-Point Estimate and Possible Range for Foreign Value Added Content of Exports in Exports by Firm Ownership, 2014



The estimates are also relatively stable at the industry level and over time between 2011 and 2014. Figure OA3 illustrates this with examples for Czech Republic and the UK, for *Food, beverages and tobacco* (C15T16), *Chemicals and chemical products* (C24), and *Motor vehicles* (C34). These two countries are

the ones with largest variations in foreign value added content of exports, as already highlighted above. But also at the industry level, the range between the minimum and maximum import content of exports remains relatively small. The largest range is found for both domestically-controlled firms foreign value added content of exports in the *Motor vehicles* sector (around 8 percentage points).

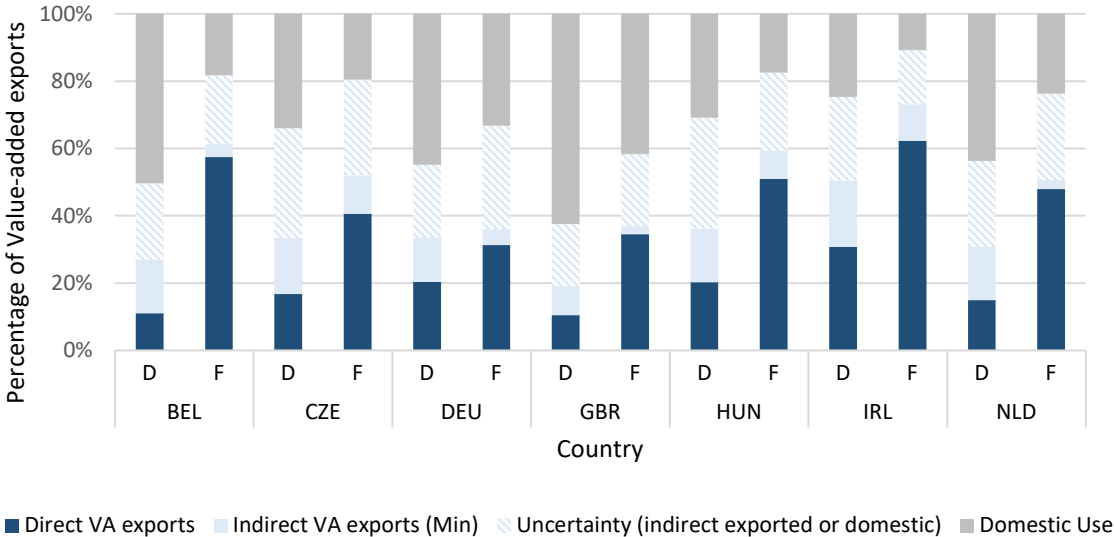
Figure OA3. Foreign Value Added Content of Exports as a Share of Total Exports, with Simulated Boundaries by Firm Ownership ^a



^a Selected industries for Czech Republic and United Kingdom

Figure OA4 illustrates the impact of the different scenarios on the channels through which the exported value added of domestically-controlled and foreign-controlled firms reaches their final markets. Not surprisingly, the directly exported value added is not susceptible to variation across the different scenarios. Having said that, indirect estimates are affected. The shaded area in the graph indicates the range of uncertainty as to the importance of each of these channels. For example, for foreign-controlled affiliates in Germany, the figure illustrates that 33% of foreign-controlled affiliates' value added is exported directly, 5% *at least* is exported indirectly, 35% *at least* is used domestically, and that there is uncertainty for 27% of value added as to whether it is exported indirectly or used domestically. The variation in these estimates is, as expected, larger than for the import content of exports, but not to the extent that it changes the overall implications of our findings. To this end, it should be recalled that the ranges reflect extreme upper and lower bounds.

Figure OA4. Export Channels Robustness Test: Uncertainty Range for Indirect Exports and Domestic Sales by Firm Ownership, 2014



Finally, it is important to note that while our study has proposed a unique and conceptually consistent combination of micro-level data with macro-economic accounting frameworks, leveraging the information obtained from both sources, the analysis is not immune to drawbacks of both sources.

Importantly, but reflecting economic reality and the high concentration of MNEs, individual foreign investors may affect overall findings in certain industries. In addition, and as a consequence of the use of macro-economic statistics, the analysis is focused on a relatively high level of industry aggregation (total economy divided in 34 industries), suggesting that there may be further differences between foreign-controlled affiliates and domestically-controlled firms. While differences in trade and production functions between them have been explicitly considered, the data do not yet allow for a more detailed breakdown by the type and sophistication of products that are produced (and traded), which may provide even more nuanced findings, e.g., on linkage creation, going forward.

Section 3. Access to National Statistics Agencies' Datasets

As mentioned in the main text, the data used in our illustrative application is gathered by OECD from the national statistics agencies of member countries and combined to create a cross-country dataset. Having said that, researchers can already access data on individual countries from the corresponding statistics agencies and, when both micro-level and IO tables data are provided, reproduce the findings obtained in our illustrative application as well as create new variables for possible use in a variety of IB studies as also pointed out in the concluding section of our research note. Whereas in most cases these data need to be purchased and/or are available to researchers only with specific conditions/restrictions, the relevant data sources are easily retrievable. To this end, Table A1 lists national statistics agencies' web links for 10 selected OECD countries for which, to our knowledge, it is already possible to gain access to data.

Looking forward, as national statistics offices of OECD countries are working towards the creation of datasets that allow for combined splits, i.e. using more than one firm dimension at a time, more extensive and inclusive datasets are likely to become available in the near future. We are also hopeful that OECD will directly publish the cross-country data retrieved. This will allow IB researchers to freely access an extensive set of cross-country variables on firms' engagements in GVCs that can be employed in a variety of studies of high relevance for the field, for instance focusing on the cross-country determinants of backward and forward linkages in GVCs.

Table OA2 – National Statistics Agencies’ Website Links to Data

Country	Website addresses
Canada	http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=301700
Denmark	https://www.dst.dk/en/TilSalg/Forskningsservice
Finland	https://www.stat.fi/tup/mikroaineistot/index_en.html
France	https://www.casd.eu/mettre-a-disposition-ses-donnees-via-le-casd/
Italy	https://www.istat.it/it/archivio/183853
Netherlands	https://www.cbs.nl/en-gb/our-services/customised-services-microdata/microdata-conducting-your-own-research/microdata-catalogue
New Zealand	http://archive.stats.govt.nz/tools_and_services/microdata-access.aspx
Norway	https://www.ssb.no/en/omssb/tjenester-og-verktoy/data-til-forskning
Sweden	https://www.scb.se/en/services/guidance-for-researchers-and-universities/mona--a-system-for-delivering-microdata/
US	https://www.census.gov/ces/dataproducts/datasets/lfttd.html