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SEI-PCS Brazil Chicken v2.0 documentation

SEI-PCS Brazilian chicken v2.0 maps the municipality of origin of exported chicken, where it was slaughtered and the deforestation risk embedded in the production of soy feed for the chicken, from 2015 – 2017. First, we link exports to slaughterhouses by integrating customs declarations with data on slaughterhouse ownership, tax registration, export licenses and consumer country requirements such as for Halal meat. We then link these slaughterhouses to the municipality where the chicken was raised using data on the origin of animals per slaughterhouse from the system of Federal Inspections of livestock. To model the origin of soy consumed by the chicken we use data on feed consumption for Brazil livestock sector, data on carcass weight per region of production, and the sourcing of soy for the domestic market developed from the SEI PCS Soy v2.4 Trase soy supply chain mapping.

Summary statistics

	2015	2016	2017
Chicken exports (Mtons)	4.10	4.19	4.14
Embedded soy in exports (Mtons)	2.65	2.87	2.75
Embedded soy area in exports (ha)	801,661	853,852	757,453
Exporting companies	92	102	106
Importing countries	150	144	142

Domestic market (%)	67.8	66.1	66.7
% trade flows with unknown municipal source of origin	4.7	4.3	4.2

Product	HS code	Conversion coefficient	% PRODUCT 2017
CHICKENS, LIVE, WEIGHT T NOT OVER 185 G (6.53 OZ.)	01051110	0.77	0.01
CHICKENS, LIVE, WEIGHT NOT OVER 185 G (6.53 OZ.)	01051190	0.77	0.01
CHICKENS, LIVE, WEIGHT OVER 185 G (6.53 OZ.)	01059100	0.77	0.00
MEAT & OFFAL OF CHICKENS, NOT CUT IN PIECES, FROZEN	02071200	1	30.44
CHICKEN CUTS & EDIBLE OFFAL (INCL LIVER) FRSH/CHLD	02071300	1	0.02
CHICKEN CUTS AND EDIBLE OFFAL (INC LIVERS), FROZEN	02071400	1	65.98
PREPARED OR PRESERVED CHICKEN MEAT OR OFFAL, OTHER	16023210	1.3524	0.48
PREPARED OR PRESERVED CHICKEN MEAT OR OFFAL, OTHER	16023220	1.3524	1.85
PREPARED OR PRESERVED CHICKEN MEAT OR OFFAL, OTHER	16023230	1.3524	1.22

Data

Trade data

Customs data for 2015-2017 covering all chicken exports under the HS code headers in Table 2. These include chicken cuts, live animals, and chicken preparations. The quality of the data is confirmed by comparing the data with other data sources and in different aggregated forms (e.g. MDIC aggregated data).

Table 2 – chicken product codes, conversion coefficients and share of each product in total exports (2017).

Domestic consumption

The domestic consumption of chicken is not estimated at all. This is not necessary for mapping the chicken exports with accuracy, and it is, at the moment, impossible to reproduce with full coverage by using publicly available information.

Production data

Production data for the years 2015-2017 was obtained from the quarterly reports on slaughtered animals by IBGE, which report heads per state of slaughter and per municipality of origin. Production data from IBGE´s municipal animal production should not be used, because they report the size of the herd as of 31st December and do not take into account that given their life short life cycles, in any given year, more chicken are slaughtered than the herd at a given point in time. Data from the system of Federal Inspections of livestock (SIGSIF) were used to link slaughterhouses with production municipalities because exports of chicken require Federal Inspection.

Carcass weights were calculated using state-specific and year-specific data, dividing the IBGE trimestral slaughter survey data (i.e. total tons of cattle carcasses per state) by the number of slaughtered heads (IBGE 2019). Where carcass or slaughter data were missing (some small producing states), we used the nationwide average carcass weight per trimester.

Logistics / asset data

The Ministry of Agriculture, through their Federal Inspection unit, provides a list of inspected slaughterhouses (a subset of the total) and international sanitary permissions. The list of Halal slaughterhouses was obtained by compiling data on each SIF approved slaughterhouse and determining their Halal licensing.

The National Registry of Legal Entities (CNPJ) provides the data needed to identify all the assets of a given exporter, and all the assets associated to a given activity (such as chicken slaughterhouses).

We used the transportation network data from the Ministry of Transport and other governmental sources to determine the actual distance between all municipalities in Brazil. This data was used exclusively to determine the shortest distance in a few specific cases where there was more than one possible municipality of origin as reported by SIGSIF. This approach and had no influence in identifying the slaughterhouse of origin.

Company data

We used the National Registry of Legal Entities (CNPJ), and also identified the subsidiaries of the main trader groups (BRF and JBS), grouping them into single entities.

Boundaries

Municipal boundaries are based on 2017 data from IBGE.

SEI-PCS Implementation

Chicken supply chain mapping

A logic-based decision tree was used to link exports back to slaughterhouses and municipalities of production.
The decision tree crosses information in the customs data against asset-level tax registrations to link exports to production municipalities where these assets are clearly linked to production activities (e.g. chicken breeding) or slaughterhouses (e.g. chicken slaughtering operations, and association to a SIF registered slaughterhouse). Where this is not the case, other datasets are used to be able to link other types of activities (e.g. meat processing, wholesale retailing of chicken meat) with farming and/or slaughtering activities in a specific asset. These datasets are export permissions per asset and country, Halal slaughterhouses and the list of countries that demand Halal meat, and the state of production as reported to the Ministry of Trade. By constraining the observed custom records to fulfil these conditions, linkages to specific slaughterhouses were found for a significative number of cases. All other custom records cannot be linked to specific slaughterhouses and the origin of the trade is considered to be unknown.

Once the link between the trade records and specific slaughterhouses is made, then the municipality of origin of the chicken is obtained from the SIGSIF data. Where this relationship is not clear, because there is more than one candidate municipality for a given slaughterhouse, a linear programming approach is used that utilises distance to optimise the source municipality. This linear programme is constrained by the SIGSIF reported flows, the ownership of assets per trader and the state of production.

Deforestation embedded in the feed consumed by the chicken

The municipality of origin for soy for each municipality of chicken production was estimated by a simple optimization of distances using linear programming. This uses information from a) soy for domestic consumption, available from Trase sub-national mapping b) demand for

soy by all animal production, including pork, beef, eggs, dairy, and aquaculture* and c) demand for soy for chicken production, including both exports and domestic chicken consumption. (*aggregated consumption of soy per animal and year is available from SINDIRACOES, and the production of each animal per municipality was obtained from IBGE).

One soy is allocated from municipalities of production to chicken production, the ratios of allocation of volume are also applied to municipal sustainability indicators associated with soy production, such as deforestation and carbon emissions. These indicators therefore provide a measure of soy deforestation and soy carbon emissions embedded in the feed for the exported chicken.