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SEI-PCS Argentina Soy v1.0 documentation

SEI-PCS Argentina soy v1.0 uses a combination of trade and production data, as well as information on company specific asset location to derive a likely department of origin for soy either exported directly as bean, or used in crushing facilities for oil and cake exports. The modelling steps rely on a decision tree to identify the likely source department (logistic hub) as well as linear programming to redistribute exports among departments of production considering the local demand for soy.

Summary statistics

	2016	2017	2018
Soy exports (Million tons soy equivalent)	51.3	38.5	27.6
Exporting companies	113	92	96
Importing countries	93	96	90
% trade flows with unknown municipal source of origin	14	11	2.9

Data

Trade data

Customs data for the years 2016 to 2018 were obtained with HS codes representing all bean, oil and cake commodities under the headers:
1201 – Soya beans, whether or not broken, converted to soy equivalents using a factor of 1.

1208 – Flours and meals of oil seeds or oleaginous fruits; other than those of mustard, converted to soy equivalents using a factor of 1.031.
1507 – Soya-bean oil and its fractions; whether or not refined but not chemically modified, converted to soy equivalents using a factor of 1.031.

When compared to annual statistics from COMTRADE, results are shown in Table 1.

Table 1: Comparison of results obtained from customs data and information retrieved from COMTRADE for the 2016-2018 period

Year	Customs data volume (tons)	COMTRADE data volume (tons)	Customs data FOB (US$)	COMTRADE data FOB (US$)
2016	50,186,240	43,796,286	19,810,882,129	17,316,220,439
2017	37,551,794	40,636,046	14,354,106,206	15,542,925,114
2018	26,931,700	31,019,401	11,233,658,425	13,097,119,198

Domestic consumption

Soy domestic demand was expressed as a function of livestock population, livestock products and seed. Demand for livestock and products was determined by estimating the animal population live weight (kg) per department (live cattle, chicken and pigs) as well as animal products (eggs) and then applying a conversion factor to represent live weight into tonnes of soy cake and bean.

Animal population was derived following the data sources listed in Table 2. Conversion of animal live weight (or egg) to soy demand relied on Brazilian feed information from Sindrações (https://sindiracoes.org.br/). The ratios of soy demand to soy production is shown in Table 3 at the national level. Demand for seed was based on a fixed ratio applied to all producing departments.

Table 2: Data sources used to derive total live weight of livestock for each department in Argentina. Results were used to estimate soy demand.

Data	Data source	Transformation, processing	Comment
Cattle	SENASA	Animal heads transformed to live weight using annual live weight for	No data available for 2017; average

		each cattle sub-category from Datos Abiertos.	population for 2016 and 2018 was used.
Pigs	SENASA	Animal heads transformed to live weight using annual live weight for each pig sub-category from the Ministry of Agriculture annual reports.	No data available for 2018 which was assumed equal to 2017.
Chicken	Combination of sources	Animal slaughter was obtained from CAPIA and crossed with slaughterhouse information from SENASA to derive the department of production.	No data available for 2016 and assumed to be equal to 2017
Eggs	Combination of sources	Animal slaughter was obtained from CAPIA and crossed with facility information from SENASA to derive the department of production.	No data available for 2016 and assumed to be equal to 2017
Seed	Report	73 kg of seed saved per hectare of soybean	Fixed ratio for 2017-2018 period in all departments

Table 3: Soy production and estimated soy demand in Argentina for the 2016-2018 period

Year	Soy production (tons)	Soy demand estimate (tons)	Ratio (%)
2016	77,856,373	3,687,775	4.7
2017	79,231,818	3,646,743	4.6
2018	49,666,655	3,056,726	6.2

Production data

Production data is available from the Ministry of Agroindustry (Agricultura- Estimaciones agrícolas), but is currently missing departments in key provinces such as Formosa and Corrientes. We used remote sensing images (Landsat images, 30 m resolution) (Global Land Analysis and Discovery, University of Maryland) of soy crop area together with soybean production yields reported by the Ministry of Agroindustry to derive production volumes per department (Table 4). Remote sensing estimates are roughly 30% greater than the estimates from the Ministry of Agroindustry.

Table 4 Differences in soybean production estimates for the 2016-2018 period considering official statistics (Ministry of Agroindustry) and remote sensing (Landsat images, 30 m resolution) (Global Land Analysis and Discovery, University of Maryland)

Year	Ministry of Agroindustry (tons)	Remote sensing (tons)	Ratio (%)
2016	58,799,259	77,856,373	1.3
2017	54,972,546	79,231,818	1.4
2018	37,787,927	49,666,655	1.3

Logistics / asset data

Logistics data is based on an extensive list of silos, crushing facilities and ports (together as assets) assembled through different official sources, as well as information on road networks. Sources are listed in Table 5.

Internal trading of soybean and oil is available by SIOGRANOS on an annual basis and following large regions containing several departments. The SIOGRANOS information is used to derive special rules about links between regions that are specific to export.

Table 5: List of datasets used for assets (silos, crushing facilities and ports) and logistics

Data	Data source	Link to datasets	Comment
Assets	RUCA	https://ruca.agroindustria.gob.ar/	Official list of assets based on resolution 21-E/2017
Assets	ONCCA	Link to ONCCA	List of operators from 2008-2012
Assets	Railway	Link 1, Link 2	List of silos that are linked to railway
Assets	Various	Company websites	
Roads	OSM	http://download.geofabrik.de/south-america/argentina.html	Open Streetmap

Boundaries

The supply chain information is mapped at the department level in Argentina using the BAHRA .The BAHRA is used to identify both departments and the locality within departments.

Some BAHRA codes also identify specific buildings or assets and are used to allocate an asset to a specific location.

SEI-PCS Implementation

A logic-based decision tree was used to link exports back to departments of soy storage facilities which serve as logistics hubs (Figure 1). The decision tree uses information from the trade data, including province of origin where available; company ownership and location of soy silos and crushing facilities; and the SIOGRANOS data on internal trading. Exports that cannot be linked to a silo in a department are labelled as unknown.

The decision tree enables traders to source from beyond their own silo network following. In using the information on internal trade from SIOGRANOS, exports are effectively shared among departments within the same SIOGRANOS zone. It is assumed that departments in these zones may either have silos or silo bags stored at a farm or property/facility. For oil and cake products, crushing facilities are mainly assumed to be located at ports (with some exceptions when a company has a crushing facility outside of the province identified as the province of origin in the trade data).

Results from the decision tree are expressed in volume of soy (as bean) sourced from the department of the logistic hubs (soy storage facilities). As such, soy oil and cake are converted to bean using an equivalence factor of 1.031 kg soy per kg of oil/cake.

Simple linear programming is carried out to make the final link between departments identified as logistics hubs in the decision tree (Figure 4) to nearby departments of soy production. This modelling step takes into account soy production, domestic demand and exports (as identified from the decision tree, Figure 4) to allocate soy exports from logistic hub departments to production departments considering the shortest distances. This optimization relied on the road network from the Open Streetmap, considering the distance between the department centroids.

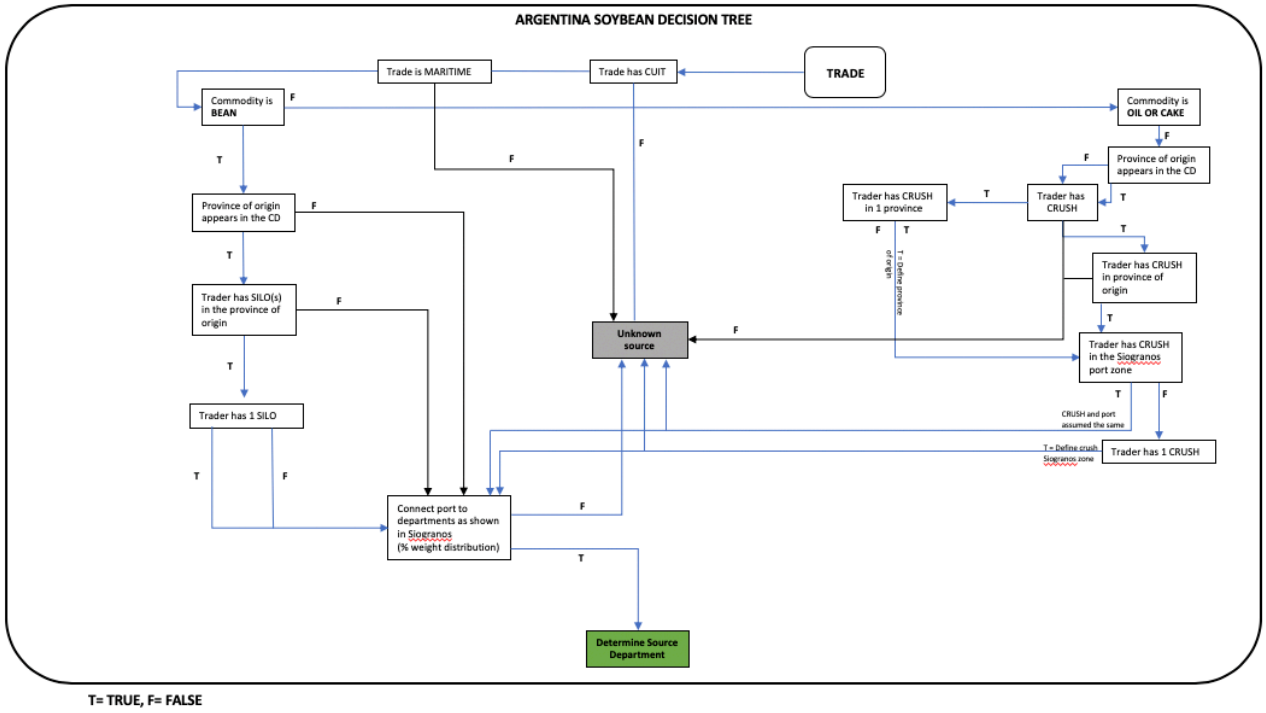

Figure 1: Decision tree for Argentina soy v.1.0 with T = TRUE, and F = FALSE. CD = Customs Declaration, CUIT = unique tax identification code.

Limitations

Given the large export of soy oil and cake, we expect crushing facilities in Argentina to source soybeans directly from Paraguay, as well as Brazil. A large volume of imports of soybeans into Argentina that is destined for crushing facilities could explain part of the uncertainty associated with the connection between crushing facilities and silos.