Ministry of Economy of Mexico-OECD Co-operation to Strengthen Competitiveness in Mexico

Market examinations in Mexico

CASE STUDY OF THE CHICKEN MEAT MARKET

2018



OECD

SE
SECRETARÍA DE ECONOMÍA

ESTADOS UNIDOS MEXICANOS

MARKET EXAMINATIONS IN MEXICO: CASE STUDY OF THE CHICKEN MEAT MARKET

2018



Please cite this publication as:

OECD (2018) Market examinations in Mexico: Case study of the chicken meat market.

This work is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the OECD or of the governments of its member countries or those of the European Union.

This document and any map included herein are without prejudice to the status or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city, or area

The OECD has two official languages: English and French. The English version of this report is the only official one.

© OECD 2018

Foreword

The objective of this report* is to identify situations that could indicate inefficiencies in the chicken meat market in Mexico. It is also motivated by the interest of the SE in having a better understanding of this and related markets. The study is part of the SE's work programme, one of its priorities being to contribute to the efficient functioning of markets, for the benefit of consumers and companies.

The methodology of *Market Examinations in Mexico: A Manual by the OECD Secretariat* was applied to carry out the research.[1] According to this document, market reviews can have different purposes:

- to identify market distortions that may be caused by the structure of the market, regulations or conduct of companies or competitors, and to propose remedial actions;
- to improve market knowledge, the ability to respond to unusual events in markets and to identify potential risks to consumers;
- to provide elements for the intervention of the authorities in different areas of public policy, such as: aspects related to consumer protection, recommendations to market participants, recommendations to different levels of government to modify laws and regulatory framework, as well as promoting better regulatory practices.

In general terms, the report contains the following elements:

- a description of the production, distribution and marketing of the chicken meat value chain, as well as a review of international experience;
- the description of the chicken meat value chain, including the identification of participants in the links of the chain, relationships between the participants, their presence in the market, multi-market contacts, the nature and characteristics of the products, as well as their possible substitutes and complements, and the description of common practices in the industry;
- structural aspects that characterise the value chain, including the level of market concentration, market shares, degree of product differentiation, cost structures, vertical integration, business strategies, market transparency, stability of the conditions of the market, information asymmetries, switching costs and the existence of purchasing power, among other elements;

* This report was prepared by Francisco Javier Nuñez Melgoza, under the direction of Sean Ennis, OECD Senior Economist and reviewed by Niccolò Comini, Competition Expert in the Competition Division, at the request of the Ministry of Economy of Mexico (SE).

[1] Available at www.oecd.org/daf/competition/Market-Examinations-in-Mexico-Manual-2016.pdf

- conditions of entry, exit and expansion, including economies of scale and scope, access to inputs, installed capacity and access to imports;
- aspects related to market behaviour and performance, such as prices, profitability, quality, innovation, contractual relations and practices of market participants;
- regulatory aspects that could impose restrictions on entry or distort incentives for market participants, affect their ability to compete and limit or distort decisions and information available to consumers.

The chicken meat market is important, as it is one of the main sources of protein for the Mexican population. In 2016, the per capita consumption of chicken meat in Mexico was 26.5 kilogrammes (kg).[2] The expenditure on chicken meat represented 7.6% of food expenditure of the basket of goods of the National Index of Consumer Prices and 8.5% of the food and beverages expenditure in households, according to the National Household Income and Expenditure Survey 2016 (Encuesta Nacional de Ingresos y Gastos de los Hogares - ENIGH) of the National Institute for statistics and Geography (Instituto Nacional de Estadística y Geografía - INEGI). In addition to its importance in consumption, the productive chain of chicken meat contributes to the generation of jobs and income.

The study is integrated as follows: Chapter 1 presents an introduction in light of the evolution of food prices and the characteristics of agricultural chains in the world; Chapter 2 discusses the general aspects of the international context; Chapter 3 analyses industry experience in the United States; Chapter 4 characterises the industry in Mexico; Chapter 5 analyses the provision of day-old chicks; Chapter 6 analyses chicken farm production; Chapter 7 discusses relationships between participants in the chain; Chapter 8 explains processing activities; Chapter 9 analyses aspects of distribution and marketing; Chapter 10 presents a price analysis. Finally, the report ends with the presentation of conclusions and recommendations.

We appreciate the collaboration of the Undersecretariat of Competitiveness and Normativity, María del Rocío Ruiz Chávez; the Head of the Competitiveness and Public Policies for Market Efficiency Unit, José Eduardo Mendoza Contreras, as well as other collaborating public servants in this unit, among them David López Victoriano, Gustavo Pérez Valdespín, Alín Martínez Morales, Saulo Dan Galaviz Espinoza, Aurelio Limón Cruz and Victor Fabián Coca Reyes. They all made valuable contributions, and supported and made comments throughout different stages of the project. In addition, interviews with officials from SAGARPA, SENASICA and FIRA were conducted, as well as with representatives of companies and associations related to the industry. Thanks to this, it was possible to obtain valuable information for the preparation of this report. It is also important to highlight the collaboration of Sean Ennis, Michael Saller and Niccolò Comini, high-level experts from the Competition Division, the OECD Directorate of Financial and Business Affairs and the OECD Mexico Centre, who contributed significantly to the direction and review of the study.

[2] In this study, the figures from the OECD-FAO database are used. This is for two reasons: the database allows analysis of the time trajectory since the 1990s and provides forecasts to 2025 and in some cases until 2030. Also, it allows comparison between different countries. There is some discrepancy with the data reported by ENIGH, according to which in 2016 per capita consumption was around 29 kg per year. The figures used in this study can be consulted in OECD-FAO, Agricultural Outlook 2016-2025, http://stats.oecd.org/Index.aspx?datasetcode=HIGH_AGLINK_2016

Table of contents

Glossary **11**

Acronyms **13**

Executive summary **15**

Chapter 1. Introduction **23**

1.1. Origins of the industry 24
1.2. General characteristics of the chicken meat production chain 25
1.3. Scale, investment and productivity 26
1.4. Comments from industry participants 27
1.5. Actions of competition authorities 27
1.6. Collaboration between competitors 30
1.7. Conclusions 30

Chapter 2. International context **33**

2.1. Meat production 33
2.2. Consumption trends 34
2.3. Poultry production by country 39
2.4. International trade of poultry meat: exporters and importers 39
2.5. Improvements in the productive process of poultry meat 39
2.6. Automation and use of technology 40
2.7. Evolution of prices 40
2.8. Conclusions 41

Chapter 3. Chain operation in the United States **43**

3.1. General characteristics of the market 43
3.2. Vertical integration and contractual relations 43
3.3. Design of contracts 44
3.4. Opportunistic behaviour or commitment problem 45
3.5. Conditions of access to capital 46
3.6. Regulatory actions 47
3.7. Antibiotics 47
3.8. Conclusions 48

Chapter 4. Characteristics of the industry in Mexico **51**

4.1. Meat production 51
4.2. Evolution of the production of chicken meat 51
4.3. Apparent consumption 52
4.4. Imports 53
4.5. Chicken meat production by state 56
4.6. Per capita consumption 57
4.7. Conclusions 58

Chapter 5. Provision of day-old chicks 59

5.1. A brief history 59
5.2. Business model 59
5.3. Participants in the industry 61
5.4. Barriers to entry 62
5.5. Substitution 63
5.6. Conclusions 63

Chapter 6. Production of poultry 65

6.1. Productive cycle 65
6.2. Heavy breeding farms 65
6.3. Incubation 66
6.4. Characteristics of production farms 66
6.5. Feeding 70
6.6. Product 73
6.7. Production and participants in the industry 73
6.8. Production costs 75
6.9. Barriers to entry 75
6.10. Substitution 76
6.11. Conclusions 76

Chapter 7. Relationships between participants in the value chain 79

7.1. Vertical integration and contracting 79
7.2. Sharecropping 80
7.3. Experience of FIRA in the area of La Laguna 81
7.4. Conclusions 83

Chapter 8. Processing 85

8.1. Structure and physiology of birds 85
8.2. Handling of birds 85
8.3. Main activities 85
8.4. Control 86
8.5. Inspection 87
8.6. Processing plants in Mexico 88
8.7. Production and participants in the industry 91
8.8. Barriers to entry 91
8.9. Substitution 92
8.10. Conclusions 92

Chapter 9. Distribution and marketing 95

9.1. Types of products 95
9.2. Preservation of cold chain 97
9.3. Participants in the industry 98
9.4. Barriers to entry 99
9.5. Substitution 99
9.6. Conclusions 99

Chapter 10. Evolution of prices 101

10.1. Consumer prices 101
10.2. Analysis of relative prices, between links in the chain 102

10.3. Analysis of relative prices of beef, pork and chicken meat 105
10.4. Mean difference analysis of final prices 107
10.5. Conclusions 109

Chapter 11. Final conclusions 111

Overview of the industry 111
International context 112
General characteristics of the industry in Mexico 112
The relationship between integrators and farmers 113
The supply of day-old chicks 114
Farm production 114
Feeding 114
Use of antibiotics 115
Processing 115
Distribution and marketing 115
Concentration 115
Barriers to entry 116
Collaboration between competitors 116
Prices and margins 116

Chapter 12. Recommendations 119

Proposal 1 119
Proposal 2 119
Proposal 3 120
Proposal 4 120
Proposal 5 120
Proposal 6 121
Proposal 7 121
Proposal 8 121
Proposal 9 122
Proposal 10 122
Proposal 11 122
Proposal 12 123
Proposal 13 123
Proposal 14 123

Bibliography 125

Annex A. Results of the price analysis 131

Tables

Table 2.1. Meat production in the world, 1967-2030 (millions of t) 33
Table 2.2. Per capita consumption of meat in the world (kg per capita), 1995-2025 35
Table 2.3. Per capita consumption of meat and poultry in the world, 1995-2025 (in kg) 36
Table 2.4. Per capita consumption of meat, selected countries, 2015 (in kg) 37
Table 2.5. Poultry meat production in the world, selected countries, 1995-2016 (millions of t) 39
Table 2.6. Imports of poultry meat and trade account in 2016, selected countries (in thousands of t) 39
Table 2.7. Prices by type of meat, average in the world 41
Table 4.1. Production of meat in carcass in 201 (thousand t) 51

Table 4.2. Apparent consumption of poultry (thousand t) 53
Table 4.3. Imports of chicken meat, 2016 USD million (md) and tt 54
Table 4.4. Imports of fertile eggs, 2012-2016 55
Table 4.5. Production of chicken meat by state, 2003-2016 56
Table 5.1. Genetic lines of day-old chicks 62
Table 6.1. Balanced feed for poultry production (thousand t) 72
Table 6.2. Stratification of poultry farms 73
Table 6.3. Live chicken production per company, 2016 (million birds) 74
Table 6.4. Cost structure of poultry production 75
Table 8.1. TIF processing plants for chickens by state, 2015 89
Table 8.2. Installed and used processing capacity by type of processing plant in 2015 (millions of birds) 90
Table 10.1. Average real price of meats per period, MNX/kg, Dec 2010=100 106
Table 10.2. Gross margin, chicken carcass/live chicken 107
Table 10.3. Whole chicken average real price, per region, 2011-2017 (Dec 2010=100) 108

Figures

Figure 1.1. Productive chain in the chicken meat industry 25
Figure 2.1. Worldwide meat production 34
Figure 2.2. Per capita consumption of meat in the world, 1995-2025 (in kg) 35
Figure 2.3. Total per capita consumption of meat and poultry,by level of development, in 2015 36
Figure 2.4. Evolution of international prices by type of meat, 1990-2016 (1990=100) 41
Figure 4.1. Production of chicken meat in Mexico, 2003-2016 (thousand t) 52
Figure 4.2. Monthly production of chicken meat, 2004-2016 52
Figure 4.3. Imports: value, volume and average price, 2003-2016 53
Figure 4.4. Imports of chicken meat, without chopping and in pieces, 2003-2016, percentage distribution, value of imports 54
Figure 4.5. Import tariffs, 2003-2017 55
Figure 4.6. Per capita consumption, real and projected, 1990-2025 (kg/yr) 57
Figure 5.1. Poultry integration 60
Figure 6.1. Productive cycle of poultry 65
Figure 6.2. Production of balanced feed in 2016, by type of animal 72
Figure 6.3. Live chicken production, 1997-2016 (million birds) 74
Figure 8.1. Chicken slaughtering capacity 89
Figure 8.2. Chicken slaughter in TIF processing plants by state in 2015 90
Figure 9.1. Commercial classification of chicken in 2015 96
Figure 9.2. Chicken marketing channels in 2015 97
Figure 10.1. Evolution of the National Consumer Price Index (NCPI) in general and for chicken, 1990-2016 (January 1990=100) 101
Figure 10.2. Evolution of relative prices of feed and inputs for feed production 103
Figure 10.3. Relative price of wholesale whole chicken in Mexico City/balanced feed 104
Figure 10.4. Relative price of whole chicken to final consumer/wholesale whole chicken in Mexico City 104
Figure 10.5. Evolution of live and carcass prices, 1980-2016 MNX/kg, Dec 2010=100 105
Figure 10.6. Relative price of beef and pork meats in comparison to chicken meat, 1980-2016 106
Figure 10.7. Relative price of chicken meat carcass/live, 1980-2016 107
Figure 10.8. Regions grouped according to the mean difference test for the price of whole chicken in Mexico 108

Boxes

Box 2.1. Chicken Production in India 38
Box 6.1. Avian influenza and its economic impact 68
Box 7.1. Characteristics of the strategic alliance between Pilgrims-Tyson, FIRA and social producers 82
Box 8.1. Main activities related to processing 86

Glossary

Biosecurity	A set of methods, techniques, devices and facilities intended to safeguard the health and life of humans, animals in laboratories and/or production units to protect the environment.
Commitment problem (hold up)	The hold-up problem occurs in an economic relationship in which one of the parties makes an investment in a specific asset, and the party that does not invest in the asset acts opportunistically to modify the terms of the transaction, to the detriment of the party making the investment.
Establishment Type Federal Inspection (Tipo Inspección Federal - TIF)	Facilities where animals are slaughtered or where goods of animal origin are processed, packed, refrigerated or industrialised, subject to regulation by SAGARPA, in co-ordination with the Ministry of Health.
Fertile egg	Egg produced in breeding plants, in which males and females coexist. The egg is fertilised and contains an embryo, whose formation has begun from fertilisation, before the egg is laid.
Good livestock practices	A set of procedures, activities, conditions and controls that are applied in the units of production of animals and TIF establishments, to reduce the hazards associated with physical, chemical or biological agents, as well as the zoo-sanitary risks in goods of animal origin for animal consumption.
Hazard Analysis and Critical Control Points (HACCP)	A systematic preventive process to ensure food safety, which is applied in industries that are related to food production.
Horizontal agreements	Anti-competitive agreements that take place between competitors.
Integrated farm	A facility responsible for raising and fattening the chicks provided by the integrating or processing company, until the conclusion of the growth phase. It is obliged to maintain the facilities in optimal conditions; act in accordance with the technical specifications established by the integrator; and apply the sanitary or pharmacological treatments prescribed by the technicians. It receives monetary or in-kind compensation, depending on the nature of the relationship agreed with the integrator.
Monopsony power	When an economic agent can lower the market price, through the control it exerts on the total demand in the market.
Moral hazard	Situation of information asymmetry, in which an individual has private information about the consequences of their own actions, but other people bear the consequences of the risks assumed.
Official veterinarian	Professional of veterinary medicine whose salary is paid by SAGARPA.
Parent stock	Birds specialised in the production of fertile eggs to produce poultry for meat production.
Poultry integrator	In the chicken industry, integrators are companies that, through some type of contractual relationship, supply day-old chicks and feed to the integrated farms, provide technical follow-up to the lot and are responsible for the sale of the poultry once its growth is complete. The integrating companies act as processors or slaughterhouses and sometimes sell live poultry.
Product system	Set of elements and concurrent agents of the productive processes of agricultural products, including the supply of technical equipment, inputs and services of primary production, collection, transformation, distribution and commercialisation.

Responsible authorised veterinarian	Professional authorised by SAGARPA, to provide its services of help and generating documents in production units; establishments that industrialise or commercialise biological, chemical, pharmaceutical, pesticides or food products for use in animals or consumption by them; authorised laboratories; TIF establishments for slaughter and processing; or others determined by SAGARPA.
Sharecropping:	Giving several animals to another person to care for and feed them, and to distribute the production in the proportion that suits them.
Slaughter	Killing an animal for consumption.
Supply-side substitution	In competition policy, this refers to the possibility of a company being subject to competitive restrictions when, because of a rise in prices, producers of other goods can modify their production processes to produce products competing with those offered by the first company.
Value chain	Set of activities necessary to conduct a product or service through the different phases of its production, delivery to final consumers and waste. Participants in the chain include suppliers of raw materials, farmers, traders, processors, transporters, wholesalers, retailers and end consumers.
Vertical integration	Situation in which a single entity takes control of different stages of the process of production or distribution of a product or service.
Vertical relationships	Vertical relationships, upstream or downstream, refer to the stages of the production process in an industry. The upstream stage concerns obtaining the necessary inputs for a productive process. The downstream stage involves the sale or distribution of the good or service produced.

Acronyms

AGP	Antibiotics for growth promotion
ARMS	Agricultural Resource Management Survey (USDA)
ASERCA	Agency for Marketing Services and Development of Agricultural Markets (Agencia de Servicios a la Comercialización y Desarrollo de Mercados Agropecuarios)
CCP	Critical Control Point
CDC	Centers for Disease Control and Prevention
CIMMYT	International Maize and Wheat Improvement Center (Centro International de Mejoramiento de Maíz y Trigo)
COFECE	Federal Competition Commission of Mexico (Comisión Federal de Competencia Económica)
CONAFAB	National Council of Producers of Balanced Food and Animal Nutrition (Consejo Nacional de Fabricantes de Alimentos Balanceados y de la Nutrición Animal)
CONAGUA	National Water Commission (Comisión Nacional del Agua
DOJ	U.S. Department of Justice
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortisation
ENIGH	National Household Income and Expenditure Survey (Encuesta Nacional de Ingresos y Gastos de los Hogares)
FIRA	Trust Funds for Rural Development (Fideicomisos Instituidos en Relación con la Agricultura)
FTC	U.S. Federal Trade Commission
GIPSA	Grain Inspection, Packers and Stockyards Administration (US Department of Agriculture)
HACCP	Hazard Analysis and Critical Control Points
HMM	Hidden Markov Models (corn)
HPAI	High pathogenicity avian influenza
INEGI	National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía)
LPAI	Low Pathogenicity Avian Influenza
MFN	Most Favoured Nation (tariff)
NCPI	National Consumer Price Index
NOM	Official Mexican Standards (Norma Oficial Mexicana)
OECD	Organisation for Economic Co-operation and Development
OIE	World Organization for Animal Health
QPM	Quality Protein Maize
PSE	Pale, Soft and Exudative (meat)

RAV	Responsable Authorised Veterinarian
SAGARPA	Secretariat of Agriculyure, Livestock, Rural Development and Food (Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación)
SE	Secretariat of Economy (Secretariat de Economía)
SENASICA	National Service for Agrifood Health, Safety and Quality (Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria)
SIAP	Agrifood and Fisheries Information Service (Servicio de Información Agroalimentaria y Pesquera)
SNIIM	National Information and Market Integration System (Sistema Nacional de Información e Integración de Mercados)
TIF	Establishment Type Federal Inspection (Tipo Inspección Federal)
UNA	National Poultry Association (Unión Nacional de Avicultores)
USDA	U.S. Department of Agriculture

Executive summary

Objective and scope of the study

This study analyses the value chain of chicken meat production in Mexico. The aim is to understand the functioning of the chain, identify distortions, providing elements for the implementation of public policies for the short, medium and long term that will contribute to the more efficient functioning of markets for the benefit of businesses and consumers, and to respond to unforeseen events that may occur in the market.

Due to the lack of information and data, the study focuses only on the analysis of the modern segment of the industry, without assessing other form of slaughter (e.g. traditional or backyard). In Mexico, this segment represents about half of chicken meat production.

To prepare the study, interviews were conducted with various authorities as well as with economic agents involved in the various stages of the value chain.

Overview

Thoroughout the world, the industry of chicken meat has experienced rapid expansion, particularly in the last 30 years. This growth has been accompanied by greater modernisation and automation, as well as by the genetic development of animal varieties that allow for greater yield. Although the consumption of the various types of meat has expanded in absolute and per capita terms, the production of chicken meat has been the most successful in standardising its processes, increasing yields, and achieving significant reductions in cost and price. Forecasts indicate that its production will keep expanding locally and internationally.

The predominant model in countries such as the United States implies a high degree of vertical integration amongst different activities: production of the fertile egg, breeding farms, processing, distribution and marketing. This model requires logistical co-ordination and programming of activities, which allows the permanent and synchronised flow of inputs and product; from the operation of broiler breeding farms, broiler farms, processing plants and delivery at the point of consumption.

In less developed countries, the industry presents some non-industrialised stages of the chain. In this case, some companies operate with different characteristics and minor scales of production compared with industrial production. They have different degrees of access to genetic technology and use the modern techniques of rearing and processing in a different way.

In the industrialised model, the large volume of birds that is handled requires close collaboration between farms and processors. There are two main modalities of this relationship: i) vertical integration, in which large companies are vertically integrated with the farms; ii) a contractual relationship, in which farms supply services to integrators, and the latter are the providers of the various inputs and are owners of the flock.

The existence of various links in production leads to the coexistence of economic agents who perform different activities. Particularly, the contractual relationship between farmers and integrators has raised concerns about the possible existence of asymmetries of power in negotiations.

Different jurisdictions, mainly in Europe and the United States, legally allow collaboration between competitors involved in agricultural activities. This collaboration should take place without affecting competition or supply and does not imply that the competition authorities may not be able to act, through the control of mergers and the investigation of anti-competitive behaviour.

International context

The consumption of meat has increased consistently over the last few decades due to an increase in both population and income. As their buying power has improved, consumers have made the transition from grain-based diets to a greater consumption of meat.

Although there has been an increase in the production of different types of meat, since the 1960s the production and consumption of chicken has grown faster. It is expected that this trend will continue due to: i) the price of this meat being lower than the price of beef and pork meat; ii) the growth process of birds being faster than that of other species; iii) greater efficiency of the productive process in the use of land, water and animal food; iv) there is a favourable perception of the nutritional qualities of chicken meat; and v) there is practically no religious restriction to its consumption. It is possible that consumption will increase more rapidly in low- and middle-income countries, which are experiencing economic growth.

World production is concentrated in four regions: the United states, China, Brazil and the European Union, which together account for almost 60% of production. Mexico, although it contributes 3% to global production, is nevertheless in deficit, and in 2016 imported 780 000 tonnes (t) of chicken meat.

The increasing use of technology has contributed to increasing productivity, which has led to a decline in relative prices, in comparison with beef and pork meat. In addition, technical change has led to a decline in real prices during the 1990s. However, starting in the mid-2000s prices of various types of meat increased significantly, in parallel to the increase in cereal prices which are used as inputs for animal feed.

The relationship between meat production and consumption of whole grains by chickens has led countries such as India to increase their production of grain, mainly maize, in the expectation of an increase in demand for chicken meat over the next few years.

The US experience and the commitment problem

This report analyses the chicken meat industry in the United States because: i) it is the world's largest producer; ii) Mexican imports come mainly from that country; iii) the industry in the United States is probably the best example of industrialised production; and iv) its operation is widely documented.

The market is characterised by an increase in concentration in processing, which is most significant when measured at the level of catchment areas of processing plants. Farmers have to be located in areas close to processing plants, which are controlled by integrators.

The chain operates based on the co-ordination of several activities. The relationship between farms and integrators is one of the most relevant aspects and is regulated through

contracts that specify the services provided by the farms. Farmers make investments financed by commercial banks to comply with the terms established in the contracts.

The contracts: i) specify the distribution of risks; ii) allow for sharing of technological progress and knowledge; iii) ensure a product of uniform quality; and iv) guarantee access to credit. However, for several years farmers have complained of low pay and a "tournament" existence. Tournaments allow integrators to establish a performance-based compensation system and solve the problem of observability of the farmers' effort.

There are several studies that have focused on the analysis of the relationship between farmers and integrators. Several authors agree in pointing out the existence of a problem of commitment or hold-up, due to: i) the specificity of the investments that the farmers make; ii) the concentration that exists at the level of influence areas of processing plants, which prevents farmers from having different options for integrators that contract their services; and iii) the lack of a guarantee for the renewal of contracts.

This means risk in renegotiation of contracts and reduction in investments, which under conditions of perfect information would lead to a level of underinvestment. However, some studies indicate a certain myopia on the part of farmers, who do not have the ability to envisage future changes in the conditions of the chicken meat market.

General characteristics of the industry in Mexico

In Mexico, chicken meat production accounts for almost half of total meat production. The market has expanded at a rate of 2.8% since 2003. However, production growth has not been sufficient to meet demand, with import value growing 140% between 2003 and 2016 and accounting for 20% of consumption. Almost 50% of the imports of pieces, primarily leg and thigh, come mainly from the United States.

There is significant tariff protection for countries with which no trade agreements exist (most-favoured nation tariff─MFN). Between 2003 and 2012 the tariff was 234% and since then has been reduced to 75%, which is the current rate.

The fertile egg is a fundamental input for the production of chicken meat on a large scale. The country has increased its imports by about 500% since 2012. One reason for the increase is the decline in domestic production caused by certain past health emergency crises.

At the federal level, the states that account for most of the production are Jalisco, Veracruz, Aguascalientes, Querétaro and Durango, providing 51% of the supply.

Per capita consumption has increased significantly. It tripled has since the beginning of the 1990s and is currently 26.5 kg per year. Projections indicate a possible 10% growth by 2025. This, coupled with population growth, could result in an increase in consumption of around 20%, which should be met by increased production or imports.

Since the 1990s, chicken meat prices have declined in real terms by about 40%.

Provision of day-old chicks

The analysis of the value chain in Mexico begins by describing the production process of the genetic lines that give rise to day-old chicks. The industrial production of chicken meat requires the permanent and synchronised provision of large volumes of fertile eggs to the incubators and day-old chicks to the farms. These inputs are mainly provided by three transnational companies that have been producing genetic varieties for several decades.

The business model of these companies is based on obtaining pure lines. Genetics companies offer fertile eggs or day-old chicks to integrators and farms. Integrators have the ability to operate breeding farms, with inputs provided by genetics companies. For reasons of cost, health care and business models, genetics companies facilitate the installation of breeding farms only to those integrators who operate on a large scale.

The available information does not permit determination of whether there is unrestricted access to fertile eggs or day-old chicks coming from genetics companies for all participants in the production of chicken meat. Apparently, large integrators have access to inputs; however, there is no information to document whether this happens with independent farms. Some interviewees have suggested that it is possible that when there is high demand, providers give preference to larger customers.

Farm production

The industrialised segment of the market follows a trend towards automation and mechanisation, from the operation of farms to processing. An increasingly uniform product is obtained by the use of genetically selected varieties and by the application of standardised procedures. Although most of the market is served in this way, in Mexico there is a segment of producers that operate independent farms, whose function is not documented.

The process begins in the broiler breeder farms; those in which parent flocks produce fertile eggs. Only the larger producers operate this type of facility, which uses birds produced by genetics companies as input.

The production's farms are the facilities in which broilers are produced. Various technical, health and legal requirements must be met for their installation. Some interviewees have reported obstacles to the full enjoyment of property rights, which may produce uncertainty and affect investments.

It was also pointed out that the regulations setting distances between farms, settlements and other facilities come from administrative agreements, which supplement the functions of official standards, although they lack the same powers of enforcement.

Interviewees indicated that the lack of co-ordination between federal, state and municipal authorities encourages local authorities to enforce provisions that are contrary to federal regulations. The regulation of land use is an example of where these differences occur.

The cost of feeding is the main production cost. That is why the large integrators are owners of facilities for the production of balanced feed. The existence of obstacles in access to food was not identified. About one-third of the birds are fed with commercial food, that is, two-thirds of the market are attended by vertically integrated companies.

The main component of bird feed is yellow corn, although white corn can be used as well. Integrators buy and mobilise large volumes of grain, which gives them an advantage in transport costs. Yellow corn comes mainly from the United States, as Mexico is not self-sufficient in this product. In this sense, having local sources of grain supply could help reduce logistical costs.

In Mexico as well as in other countries, antibiotics are not used for preventive purposes or as precursors of growth. Also, it is necessary to suppress their use with enough time for their elimination before slaughter. These provisions are not mandatory.

There is no information to determine how many farms exist, how many operate under contract, how many are independent or how many belong to integrators. According to the

National Union of Aviculture (Unión de Avicultores – UNA) data, there are fewer small companies than in 1996 and the larger ones comprise a larger proportion of the market, potentially indicating an increase in market concentration.

In relation to barriers to entry, the conditions under which small and medium-sized enterprises could access genetic lines are unknown. Due to investment reasons and timely and sufficient supply, it is difficult for a medium or small company to invest in processing plants. These facilities require the continuous operation of a "production train" that guarantees the permanent provision of poultry, which can only be achieved if there is a significant number of farms operating with staggered calendars. At the various links in the chain, specific investment is required, and it can represent significant sunk costs. All of the above is indicative of barriers to entry.

Relations between integrators and farmers

Unlike the United States, in Mexico some processing companies have opted to vertically integrate farms' operations. The largest chicken meat producer follows a model of vertical integration with farms.

Likewise, there are alternative contractual modalities, like sharecropping. The only documented sharecropping model in Mexico is situated in La Laguna region, which covers part of the states of Coahuila and Durango, in the north of the country. For three decades a strategic partnership has been established between producers, mainly from the social sector and the Pilgrims-Tyson company, with the participation of Trust Funds for Rural Development (Fideicomisos Instituidos en Relación con la Agricultura – FIRA).

The scheme, which operates the strategic alliance between Pilgrims-Tyson and producers of the social sector, is similar to those used in the United States, including the existence of tournaments. The distinctive feature is that in the Laguna experience, FIRA has intervened to establish conditions that guarantee sufficient supply of day-old chicks to the farms, so that the social producers maintain the necessary income flow to fulfil their credits.

This has apparently prevented the ex-post renegotiation of contractual terms. It is therefore of great importance to carry out an evaluation of the programme in order to use its favourable aspects for the development of other producers in other areas.

Processing

Industrialised poultry processing requires a variety of activities, including the moving and handling the birds from farms to processing facilities. In the larger plants, some of these activities are carried out in an automated or semi-automated manner.

The industry applies control mechanisms, including the Hazard Analysis and Critical Control Point (HACCP) tool, which is included in the NOM-251-SSA1-2009 official standard. The plants must comply with regulations for their installation and operation, which emphasise aspects related to construction, sanitation, equipment and processes. Notably, TIF plants require inspection by an official or authorised by SAGARPA veterinarians.

There are 34 TIF facilities for chicken slaughtering. There are also private and municipal facilities, whose number and location are unknown. Slaughter in one of these three types of facility represents between 47% and 57% of the total slaughter. The rest is carried out outside any type of plant.

TIF facilities represent 88% of plant processing. This means that between 43% and 53% of the total slaughter is carried out in TIF facilities.

Large-scale processing requires a continuous supply of birds, so the processor must have supply relationships with the farms. For a farmer, it is difficult to face the cost of investing in a processing plant as well as ensuring the provision of poultry for the plant.

According to some interviewees, larger processors may face limitations to accessing the modern retail segment, due to the existence of practices such as category management, category captaincy and quota allocation. Unfortunately, there is no information to document these behaviours.

The interviewees also indicated that in some municipalities the authorities request slaughtering in the municipal facility. When this is not possible, the authorities charge even if slaughtering is not carried out in that facility.

Distribution and marketing

The product reaches the market through various distribution channels. There is a notable trade in live birds, which represents 38% of those produced. Downstream in the chain, the market is competitive, as the product reaches the consumer through various specialised retailers, public markets, over-the-counter markets, street markets, grocery stores and supermarkets.

According to the commercial classification of the product, most of the consumption is represented by live chicken (38%) and rotisserie (32%).

In terms of marketing channels, poultry shops serve 43% of the market, with 21% going through the public market and 15% through supermarkets.

There may be inconsistencies between figures provided by different sources, including UNA, the National Institute for Statistics and Geography (Instituto Nacional de Estadística y Geografía – INEGI) and the Service Agrifood and Fisheries Information (Servicio de Información Agroalimentaria y Pesquera – SIAP). The lack of a centralised information system makes it difficult to establish precisely the structure of the market.

Available information indicates that there are 632 wholesale chicken marketers; more than 46 000 chicken outlets; more than 6 000 supermarket stores and more than 600 000 grocery stores and other types, of which an undetermined proportion is known to be involved in retail chicken marketing.

According to interviewees, it is possible that 30% of the chicken coming from integrators will be marketed as live chicken that goes to the market through undocumented channels.

There do not appear to be any significant restrictions on retail chicken marketing.

Prices and margins

Since the 1990s consumer prices of poultry meat have declined in real terms by about 40%, according to the National Index of Consumer Prices.

In order to find out more about the mechanisms of price formation between the links in the chain, several statistical exercises were carried out to determine relative prices, with information provided by the National Information and Market Integration System (Sistema Nacional de Información e Integración de Mercados – SNIIM), INEGI and SIAP.

In particular, the possible stationarity of relative prices was analysed between: i) certain inputs (yellow maize, sorghum and soybean paste) and balanced feed; ii) balanced feed and

chicken in the wholesale channel; and iii) the whole chicken in the wholesale channel and its price for final consumption.

The exercise concluded that the relative prices of some of the links in the value chain are stationary.

Likewise, the behaviour of beef, pork and chicken prices since the 1980s has been analysed. In this perspective, chicken decreased in real price by more than 50%, on foot and processed. The decline in real prices of beef and pork was lower than chicken meat prices.

Regarding the gross margin in poultry meat, between 1990 and 2010 there was a significant decline from the prevailing level in the 1980s, but in the 2010s there was a recovery. The only information about profitability is published by Industrias Bachoco, which indicates that in 2016 it had an EBITDA (earnings before interest, taxes, depreciation and amortisation) of 11.1%. It is difficult to compare this result, since public companies from other countries also offer other products besides chicken meat.

Finally, an analysis of difference of means was carried out in order to obtain evidence about the way final prices are established at the geographical level. The exercise concluded that there are five regions, which group entities into which prices have similar behaviour. These regions represent 12 entities. In the rest of the states, the information indicates that it is possible that final prices depend on local characteristics. This, together with the diversified location of TIF slaughter facilities and the need for rapid mobilisation of fresh poultry to its places of consumption, indicates that markets may be local or regional.

Chapter 1. Introduction

Over the past decade, there has been an increase in food prices at the international level. OECD member countries have not been the exception. Mexico has been identified as one of the countries in which the increase in food prices relative to other products has been more pronounced (OECD, 2014).

There is no single explanation for this phenomenon. For instance, agricultural production is affected by climatic conditions, access to water, phytosanitary conditions, market structure and value chains.

As a result, there is renewed interest in the functioning of food markets. In the case of meat products, this interest is stimulated by the prospects of per capita income growth and population growth, which will increase demand over the next few years. This has generated the need to study several aspects such as:

- the evolution of production and demand by type of meat (beef, pork, chicken, fish, etc.);
- market structure composing the agricultural value chains;
- analysis of the markets for the inputs needed to achieve the expansion of production, particularly the grain markets;
- the most efficient use of water, both for the production of animal feed and for the production of meat;
- the environmental impact of the production of meat products;
- the phytosanitary provisions that need to be implemented to produce meat in a safe environment for animals and humans;
- the role of distribution and marketing;
- the role of regulation and public policies that can influence the efficient performance of markets;
- the possibility of anti-competitive, unilateral or co-ordinated behaviour of those involved in the production chains (OECD, 2014; US Department of Justice, 2012; American Antitrust Institute, 2008).

The following sections present an overview of the organisation of the industry, its characteristics, production and business aspects, based on the experience in recent years, with the aim of contextualising the recent development of the industry; later sections will provide more detailed analysis.

1.1. Origins of the industry

The production of poultry meat is a relatively new industry. Before the Second World War, chicken meat was a by-product of the egg industry. Until then, the animals were small and of low weight.[3] From the conclusion of the war and due to the rationing of red meat, the organisation of the industry was initiated, for which resources were allocated for the creation of production and research facilities. Farms grew in size and chicken production was separated from that of other birds and egg production.

New technologies were introduced over the years and the size of farms increased, which generated the need for more capital. This, coupled with price variability and phytosanitary emergencies, led to the production of fattening birds being risky to farmers from an economic point of view.

Integrators emerged within the industry, which built incubators, plants for food production and processing plants, and whose operation sought to meet the demand for a product of uniform quality (Vukina 2001).[4] The integrators chose to supply chicken from their own farms or from third parties, through production contracts. In some countries, such as the United States, contract production was favoured, through farms belonging to third parties, who invest their capital or obtain credits, and are responsible for the care and monitoring of bird growth.

The business model of the industry reveals that the activities of the processing plants play an important role in the generation of added value, particularly in developed countries where there is a significant demand for boned and pre-cooked products.[5] While in low- and middle-income countries a significant part of consumption is fresh product, the trend is that in the coming years the demand for processed products will increase (Dicks, 2010).[6]

[3] For example, in the 1920s chickens were bred in small backyards and the same animals were used for the production of chicken and egg. It took 112 days (16 weeks) to produce a 2.5 lb (1.13 kg) weight chicken. In recent years, it takes 47 days (6-7 weeks) to raise 6.2 lb. (2.81 kg) chickens. See Barbut, S. (2015), The Science of Poultry and Meat Processing, Chapter 2, http://www.poultryandmeatprocessing.com

[4] The author points out that the main reason for vertical integration and the emergence of contracts with independent farmers in the poultry industry is closely related to the possibility of distributing the risk; disseminating technological progress and innovation; consumer demand for products with good reputation and uniform quality, and access to capital. Vertical integration encompasses production, processing and distribution. The physical production of poultry is almost entirely confined to independent farmers contractually engaged with integrators, which facilitates the achievement of efficiency and provides responsiveness to the industry, allowing some companies to be large global competitors in the market of meat.

[5] Processing plants generate most of the value added of the products (boned and pre-cooked). However, they require substantial capital investment and a guaranteed supply of day-old chicks, which makes their independent operation unviable. See Dicks, M. (2010), "Concentration and Competition in the Poultry Industry", The Department of Justice and the U.S. Department of Agriculture (USDA) second joint public workshop on competition and regulatory issues in agriculture held on May 21, 2010, https://www.justice.gov/sites/default/files/atr/legacy/2010/06/03/AGW-15685-a.pdf

[6] The US experience shows how consumer patterns have changed. In the sixties, 80% of the consumption was of whole chicken, 15% of pieces and 3% of processed chicken. In the 2010´s, the whole chicken represents only 10% of the demand; pieces 40% and the processed chicken, 50%. See Barbut (2015), chapter 2.

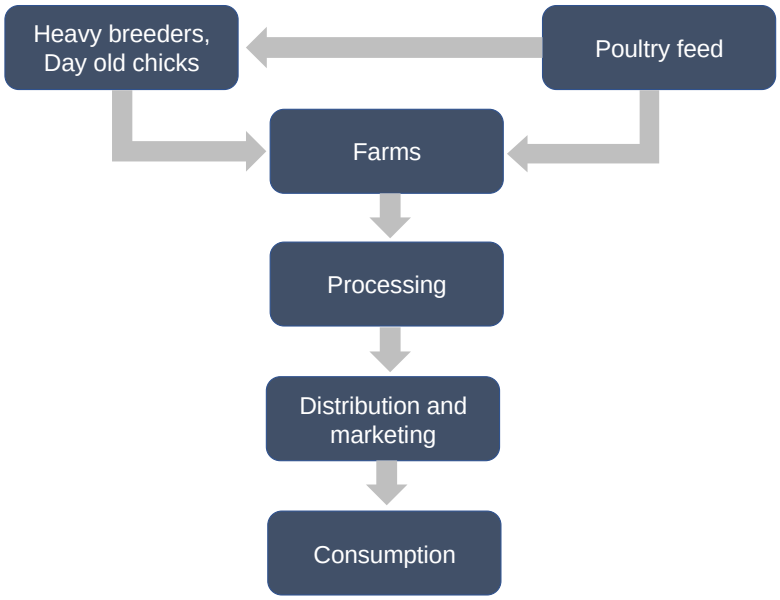
Risks inherent in the industry hinder the independent operation of breeding and processing activities. Also, the integrating companies could face the competition of other integrators as well as processors of other types of meat.[7]

Production contracts have evolved and can be very detailed. In addition, they have led to the emergence of incentive schemes that seek to influence the relative performance of farmers. In this way, farmers can get higher payments when costs are below average and vice versa. Production contracts allow producers to operate free of most of the risks inherent in marketing; price volatility, production risks and uncertainty over input productivity.[8] Independent producers must bear most of these risks. Later, we will go into this subject more deeply.

1.2. General characteristics of the chicken meat production chain

The production chain of chicken meat includes, among others, the following activities: reproduction to obtain day-old chicks; provision of food, both for the facilities that produce day-old chicks and broilers; production in broiler farms; processing; distribution and marketing; and consumption. In the development of these activities, relations are established between producers and intermediaries. Each link has its own characteristics and there are various contractual relationships and vertical integration between economic agents.

Figure 1.1. Productive chain in the chicken meat industry



Source: OECD

[7] Dicks points out that integrators have little flexibility in pricing, because they not only have to compete with each other, but with processors of other types of meat both nationally and internationally. Integrators depend on large supplies to maximise return on investment by maximising sales for every dollar invested in fixed assets.

[8] However, producers associated with integrators via contract have increasingly expressed their disagreement with contractual terms and asymmetry in the relationship. This situation is more evident in the case of the United States. The issue will be discussed in more detail later. See Department of Justice (2012) and American Antitrust Institute (2008).

The operation of the chain requires considering that the product must be preserved, as it is perishable. In this way, cold chains must be available to guarantee the integrity of the product. There should also be special facilities for both breeding and processing.

In general terms, it is known that the production of unprocessed food is carried out in fragmented structures, involving many producers. This is the case of cereal production needed for food (corn, soybeans and sorghum). Cereals are demanded by food producers or agro-industrial companies. Some products are processed into oils (for example, soybeans) whose residual product is soybean paste, which in turn is used by food producers.

Animal feed producers sell their product to farms. There is also the case of chicken processors that are integrated vertically with the production of balanced feed and use it to supply their own farms or to farms with which they maintain a contractual relationship of sharecropping.

Presumably the grain market structures supplying the chicken meat production chain are less concentrated than the processed food processing link. In such circumstances, the bargaining power of farmers may be disadvantageous in relation to producers of balanced feed (Commission of the European Communities, 2009c).

The link corresponding to the provision of parent stock or fertile eggs for reproduction is concentrated in a few transnational corporations, as will be seen below.

Breeding takes place in multiple productive units, which may or may not be integrated vertically with the companies that are responsible for the processing of the animals. Processing can be carried out in industrial units from which the product is put on the market in various presentations, or it can be carried out in backyards by small and medium introducers who purchase the live chickens from the farms.

The distribution and marketing are carried out by various economic agents operating in traditional and modern channels.

This means that there is an interaction between economic agents located in different links of the chain, with varying degrees of concentration. This fact and the particularities of the demand, determine the share of each link in the distribution of value added.

1.3. Scale, investment and productivity

Significant investments are required by integrators and farmers to produce poultry products. It is estimated that in the United States, a typical complex that includes incubator, food plant and processing plant, requires investing USD 100 million, while the investment of the farm is USD 90 million dollars (Dicks, 2010). The same source indicates that the return on assets is relatively low, both for producers and for integrators, so the business model requires the commercialisation of large volumes of product.

The industry has implemented various strategies to maintain productivity and profitability, such as developing new genetic varieties, increasing the average size of farms; technifying the process; and research on the impact of temperature and food on growth, among others. The result is that it has been possible to increase the average size of the birds and the efficiency of the feeding. For example, the average live weight in the United States increased 10% between 2000 and 2010 and feed productivity improved; in 2000 it was necessary to use 1.95 kg of food to produce one kg of meat, while in 2010 only 1.92 kg were required to produce the same result.

However, the industry faces challenges that threaten its productivity. In some countries, the conditions for access to financing have become more unstable, which impacts the ability to make investments, particularly in the model of production contracts. The volatility of grain prices has affected production too. In several countries, the price of inputs such as electricity and gas has increased.[9] According to comments of the producers, including those interviewed for this study, the gross margins have decreased for both producers and integrators.

1.4. Comments from industry participants

The processing industry has made significant efforts to improve operational efficiency. Unlike agricultural activities, where overcapacity manifests itself in greater supply on the market, in the chicken meat industry, integrators have the capacity to manage excess capacity to avoid negative effects on price through administration of delivery times and harvesting of the birds to the farms or by the reduction in the volume of day-old chicks they receive.

In the United States, these actions have raised concerns among farmers, who get loans to finance the installation and expansion of farms, based on financial projections supported on the volume of birds they expect to be supplied by the integrators. A reduction in this volume can affect farmers' incomes and jeopardise their ability to meet their financial commitments.[10]

The inability of finding alternative uses for farm assets and the difficulties in accessing other integrators has led to a discussion about the possible existence of a problem of commitment.

1.5. Actions of competition authorities

Concerns about price and cost increases, as well as indications of anti-competitive behaviour, have led to a variety of actions by competition authorities in several countries in recent years, as shown below.

1.5.1. United States

In the case of the United States, several workshops co-ordinated by the Department of Justice, were conducted in 2010 to discuss regulatory and competition issues affecting the activities of agents involved in agricultural production.[11] A wide variety of parties involved in the food industry, such as farmers, ranchers, processors, marketers, academics, regulators and authorities at various levels of government, participated in the meetings. The dynamics of competition in the markets were discussed in the workshops, including issues of market power and vertical integration. Several horizontal issues were identified, such as those related to the increase in market concentration, monopsony power, market

[9] The DOJ study reports several complaints from meat producers related to increases in various costs, including natural gas, diesel, insurance and general inputs. See Department of Justice (2012).

[10] Idem.

[11] Documentation and videos available on Department of Justice website, https://www.justice.gov/atr/events/public-workshops-agriculture-and-antitrust-enforcement-issues-our-21st-century-economy-10

manipulation, market transparency, contracting, and regulatory burden and price volatility, among other aspects. In the case of the chicken industry, there are complaints about different cost increases, the greater concentration on the number of integrators, farmers' dependence on them and the structure of contracts that governs the relationship between the two.[12]

In September 2016, a collective action procedure was initiated against more than 12 of the largest processing companies, with the objection that they were colluding to inflate the price paid by wholesalers. In that lawsuit, it is pointed out that Agri Stats is used as a system that provides comprehensive data about internal operations of larger companies, including poultry size, product mixes and financial returns.[13] The information collected represents more than 95% of chicken processing in the USA (Leonard, 2017).

In February 2017, a group of 5 farmers filed a civil lawsuit in a Federal Court in Oklahoma to seek compensation, against the 4 largest chicken meat processors. The complainants point out that the processors establish secret agreements to pay low compensation to the farmers. Likewise, the accused have been singled out for not agreeing to enter contractual relations with farmers who had previously worked with other processors (Nosowitz, 2017). The case is under investigation.

1.5.2. European Union

The report issued by the European Competition Network on the activities of competition authorities in Europe between 2004 and 2011 indicates that during the period more than 180 cases were handled in the food sector. Five of them were cases of conduct, mostly horizontal, in the chicken meat market in Bulgaria, Spain, Malta, Norway and the Czech Republic (European Competition Network, 2012).

The cases have occurred in an environment of increased concentration at the farm level, which has also been accompanied by pressures on profitability due to increases in food prices and energy and regulatory changes to improve hygiene and animal welfare (European Competition Network, 2012).

In Bulgaria, in 2008, the competition agency investigated and fined the union of breeders that implemented agreements that established minimum prices, limited production and established quotas. The agreements also established an information exchange mechanism with the objective of monitoring compliance (European Competition Network, 2012).

[12] Farmers have repayment terms of their investments between 15 and 25 years. The best scenario for them is to have access to several competing integrators. Actually, that does not happen. The distance of transfer of the chicken to the processing plant cannot be too extensive, which limits the options of farmers. According to farmers and some studies, the integrators may tacitly decide not to compete to hire the farmers, resulting in the latter being permanently linked to an integrator. See American Antitrust Institute (2008), p. 305; Department of Justice-USDA (2010), Public Workshops Exploring Competition in Agriculture, Poultry Workshop, May 21, 2010, https://www.justice.gov/atr/events/public-workshops-agriculture-and-antitrust-enforcement-issues-our-21st-century-economy-10

[13] Producers have indicated that they have limited access to economic information on production contracts. In contrast, integrators have access to detailed information shared through Agri Stats. See Taylor, R. and D. Domina (2010), "Restoring Economic Health to Contract Poultry Production", http://www.dominalaw.com/documents/Restoring-Economic-Health-to-Contract-Poultry-Production.pdf

In Spain, in 2009, a sectoral organisation which adopted price recommendations for its members, through the publication of press releases and public declarations announcing price increases, was fined.

In 2011, the competition authority of the Czech Republic penalised farmers for setting prices for their common consumers.

The Malta competition authority investigated an agreement between operators of incubators, breeders and processors that included the use of the same brand and exclusivity obligations. The agreement prevented breeders from hiring with competing processors. The agreement included a penalty clause.

In 1999, in Norway, the authority intervened to penalise the Norwegian Egg and Chicken Co-operative which had a market share of 90%, for refusing to purchase chicken from imported breeding stock. The refusal applied only to two incubators that did not belong to the co-operative. The co-operative justified the conduct in terms of restrictions on the imports of chicken for reasons of quarantine.

Moreover, several authorities reviewed mergers in the industry, some of which were subject to conditions and even objected to. In Denmark, the authority analysed the acquisition by the Svenska Lantmännen co-operative of Spira Group. The buyer had a strong position in raising and selling chickens. The operation was conditioned on non-discriminatory treatment obligations to third parties.

The French authority analysed a merger involving risks of access to input, given the position of the participants in the production and marketing of chickens. The parties were forced to divest in upstream and downstream markets.

The Hungarian authority cleared a merger between a producer-distributor and a processor, once the parties offered remedies to address concerns by cross-directories.

The Norwegian authority banned the merger between the largest breeder and processor of chicken and the largest meat processor. The agency considered that the transaction would eliminate a potential competitor in the chicken market and reduce the intensity of competition.

In 2015, the French authority sanctioned a group of companies and professional associations for colluding in wholesale chicken meat prices.

1.5.3. Mexico

The competition authority sanctioned several agreements between producing companies to fix the price of chicken meat, with the intermediary of the association that groups them (COFECE, 2016b). On the other hand, in 2015 the agency authorised the merger between Pilgrim´s Pride and Tyson.[14]

[14] COFECE determined that in the production of broilers, the Herfindahl-Hirschman Index was aproximately 1 600 points, with a competitive fringe of small producers of 37%; in live chickens, the index would be located at levels close to 1 080 points, with a competitive fringe of 42%; and in processed chicken, the index would be at levels of around 800 points, with a competitive fringe of around 60%. For the Mexican agency, risks to competition exist when the Herfindahl-Hirschman Index is higher than 2 000 points. Afterwards, the criterion applied by the authority will be deepened. See COFECE (2015a), file CNT-088-2014, http://cofece.mx/CFCResoluciones/docs/Concentraciones/V704/0/2070270.pdf

1.5.4. Other countries

In 2016, the Pakistani competition authority sanctioned the local poultry association for influencing prices, production and sales of chicken products. The association published advertisements in newspapers in which it divulged information on the prices of live birds, chicken meat and eggs.

1.6. Collaboration between competitors

The European Union applies provisions that allow for collaboration between competitors in agricultural activities, including chicken production (European Commission, 2016). The Treaty on the Functioning of the European Union gives a special status to the agricultural sector in relation to competition laws, which can be applied considering the five objectives of the Common Agricultural Policy.[15] The objectives of the Policy have pre-eminence over purposes of the treaty.

There are various derogations and exemptions from competition laws that allow agricultural producers to engage in different joint activities, including production planning, joint supply of inputs, and joint storage, distribution and marketing.

The conditions that producers must meet are: i) they are integrated into producer organisations; ii) the activities of the organisations allow the achievement of efficiencies; iii) that the organisation's sales do not exceed a threshold of 15% of national production.

In the United States, the Capper-Volstead Act lists various activities allowed to agricultural co-operatives and authorises them to develop profitable activities. The act allows: i) the combination of farmers to constitute a power to counteract the bargaining power of buyers; and ii) processing, distributing and marketing farmers' products more efficiently and potentially avoiding intermediaries.

The Supreme Court ruled that the act does not allow for predatory practices or collusion with other organisations that do not enjoy immunity (Varney, 2010). The view of competition authorities has been to allow marketing as effectively as possible without limiting production.[16]

1.7. Conclusions

The poultry industry involves a variety of activities: fertile egg production, production of day-old chicks, production of broilers, processing, distribution and marketing.

The predominant model in countries such as the United States, involves the vertical integration of most of these activities. This model requires logistical co-ordination and activity scheduling, allowing the permanent and synchronised flow of inputs and output, i.e. from the operation of breeding farms, production farms, processing plants and delivery to the points of consumption. Industrial production is stimulated by consumer trends that

[15] The objectives are: i) to increase the productivity of the sector; ii) to ensure a fair standard of living for farming communities; iii) market stabilisation; iv) security of supply; and v) to ensure reasonable prices for consumers.

[16] By 2008, it is estimated that there were some 3 000 co-operatives of agricultural producers, representing a turnover of USD 191 billion (Varney, 2010), p. 6.

show a growing consumer preference for value-added products such as boned and pre-cooked products.

In less developed countries, the industry also operates under non-industrialised models in some stages. In this case, companies operate with different characteristics, with scales of production smaller than those of industrial production, have different degrees of access to genetic technology and use modern breeding and processing techniques in a different way. These companies meet the demand for fresh products in some markets.

In the industrialised model, the large volumes of birds that are managed require close collaboration between farms and processors or integrators. There are two main modalities under which the relation is given: i) vertical integration, that is, the processors integrated vertically with the farms; and ii) a contractual relationship, in which the farms are service providers of the processors or integrators, and the latter are the suppliers of the various inputs and owners of the flock.

The existence of several links in production leads to coexistence between economic agents who carry out various activities. The contractual relationship between farmers and integrators has raised concerns about the possible existence of asymmetries of power in the negotiations. An element that has been present for a long time in different jurisdictions, mainly European and in the United States, is the possibility of collaboration between competitors involved in agricultural activities. This co-operation must take place without actions that reduce competition or reduce supply, and does not imply that competition authorities cannot act.

Chapter 2. International context

This chapter presents an overview of some general aspects of the international chicken meat market, including: the evolution of its production and consumption; the identification of major producer and consumer countries; its international trade; and the evolution of prices.

2.1. Meat production

Meat consumption has steadily increased for several decades. The reasons are the growth of the population and average income, which has allowed a move from a diet based on cereals to a diet in which there is a greater consumption of meat.

Among the most popular types of meat are red meat (cattle, sheep), white meat (mainly poultry and in some cases, pork) and seafood (fish and shellfish).

The production of all types of meat protein has increased, although pork and farmed fish and poultry, particularly chicken, have been more prominent.

If we refer only to red meat and poultry,[17] their production increased from 92 million t at the end of the 1960s, to 300 million t in 2015. Table 2.1 shows the evolution:

Table 2.1. Meat production in the world, 1967-2030 (millions of t)

						Growth rate
Period	**1967/69**	**1987/89**	**1997/99**	**2015**	**2030*/**	**1967-2015**
Cattle	38	53.7	58.7	74	88.4	1.43%
Pork	34.1	66.3	86.5	110.2	124.5	2.53%
Sheep	6.6	9.1	10.8	15.3	20.1	1.80%
Poultry	12.9	37.2	61.8	100.6	143.3	4.47%
Total	91.6	166.3	217.8	300.1	376.3	2.56%

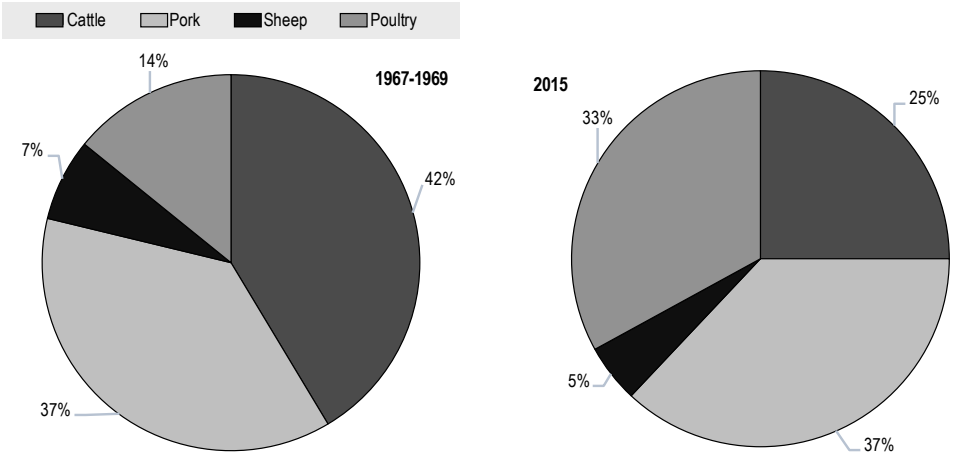
* Forecast
Source: FAO, World Agriculture: Towards 2015/2030. An FAO Perspective. http://www.fao.org/docrep/005/y4252e/y4252e07.htm

As can be seen, total production has increased at a rate of 2.6% per year. However, cattle and sheep production has increased at rates of 1.4 and 1.8%, while poultry has expanded at

[17] There are different varieties of birds: chicken, turkey, duck, goose, guinea fowl, pigeon and quail, among others. However, in the Mexican case the consumption is concentrated on chicken and turkey, with chicken being the product that represents approximately 99% of the reported production of birds while turkey makes up the remaining 1%. The rest of the varieties have no records. Because of the importance of chicken, data are generally used for birds in general as approximate to those corresponding to chicken, when these are not available. See SAGARPA (2010b), "La producción de carnes en México 2010", Claridades Agropecuarias, pág. 19, http://www.infoaserca.gob.mx/claridades/revistas/207/ca207-19.pdf

a rate of 4.5%. As a result, the distribution of meat production has been modified. Avian production increased from 14% of the total to 33% in 2015. In contrast, beef production fell from 41% to 25%.

Figure 2.1. Worldwide meat production



Source: FAO, World Agriculture: Towards 2015/2030 An FAO Perspective.

Among the types of meat considered, avian meat went from being the third source of meat protein to being the second one. That increase of share was totally won by beef. The projection is that by 2030, chicken meat will be the first source of meat protein with a share of 38% of the total.

The reasons for this forecast are: i) the price of poultry is lower than that of red meat; ii) birds require shorter growth processes than other species; iii) production is more efficient; iv) consumers have a favourable perception of their nutritional properties; and v) there are virtually no religious restrictions on consumption (Barbut, 2015).

Consumption is expected to increase significantly in some densely-populated countries, which currently have low or medium incomes, but which is increasing rapidly, as in the case of China, India and Russia. There may also be a government effort to favour the production of meat of avian origin, due to considerations of efficiency and use of natural resources.

Chicken is the most popular poultry product. The trend is to concentrate the production in large complexes, operated by companies that participate in different links of the productive chain. For logistical reasons, costs and management of phytosanitary contingencies, the industry shows a trend towards consolidation in large specialised companies, some of which operate internationally.

2.2. Consumption trends

Per capita consumption of meat increased by 24% between 1995 and 2015 and is expected to increase by another 3.5% from 2015 to 2025. The composition of consumption has changed as shown in the following table:

Table 2.2. Per capita consumption of meat in the world (kg per capita), 1995-2025

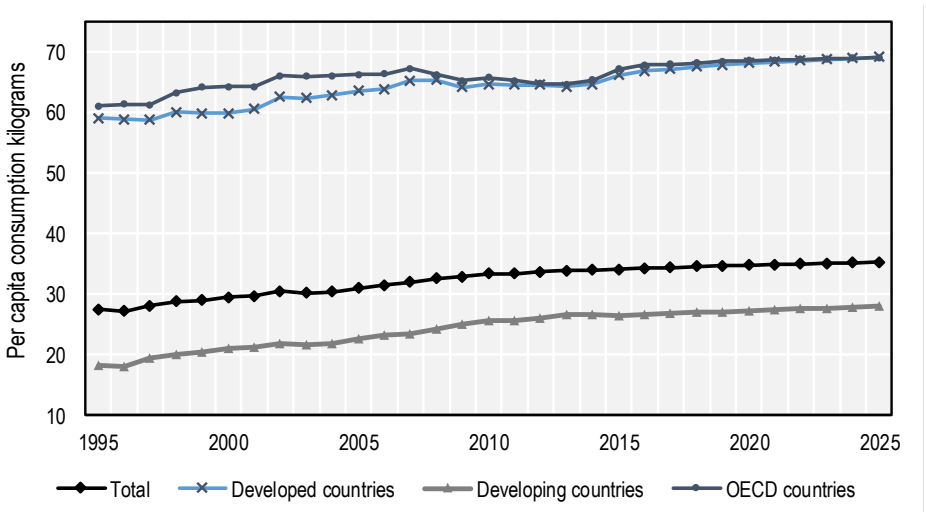
	1995	% total	2015	% total	2025	% total
Cattle	6.77	24.6%	6.43	18.9%	6.67	18.9%
Pork	10.61	38.6%	12.48	36.6%	12.54	35.5%
Sheep	1.59	5.8%	1.71	5.0%	1.89	5.4%
Poultry	8.54	31.0%	13.48	39.5%	14.2	40.2%
Total	27.51		34.1		35.3	

Source: OECD-FAO Agricultural Outlook 2016-2025.

As can be seen, between 1995 and 2015 poultry meat has gone from representing 31% of per capita consumption to almost 40%. In contrast, beef decreased from 24.6 to 18.9% and pork went from 38.6 to 36.6%. It points out that the per capita consumption of beef has declined in absolute terms. The proportions are expected to change little by 2025.

Meat consumption shows differences between developed and developing countries. Figure 2.2. indicates that by 2015, the population of developed countries had a per capita consumption much higher than the population of developing countries. In 2015, for example, people in developed countries consumed 66.1 kg of meat, practically the same as the countries of the OECD, while the inhabitants of developing countries consumed 26.5 kg. The world average was 34.1 kg.

Figure 2.2. Per capita consumption of meat in the world, 1995-2025 (in kg)



Source: OECD-FAO Agricultural Outlook 2016-2025.

Table 2.3. summarises the trend of total and avian consumption in the different groups of countries:

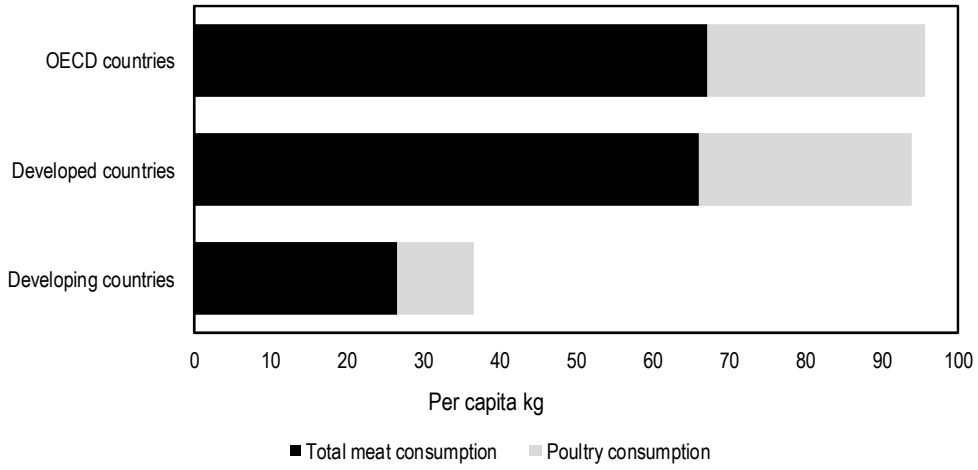
Table 2.3. Per capita consumption of meat and poultry in the world, 1995-2025 (in kg)

	1995	2015	2025
Developed countries			
Total meat consumption	59.07	66.11	69.16
Poultry consumption	18.55	27.85	30.01
Poultry/total %	31.4%	42.1%	43.4%
Developing countries			
Total meat consumption	18.31	26.51	27.96
Poultry consumption	5.63	10.07	10.77
Poultry/total %	30.7%	38.0%	38.5%
OECD countries			
Total meat consumption	61.06	67.11	69.08
Poultry consumption	20.51	28.58	30.38
Poultry/total %	33.6%	42.6%	44.0%

Source: OECD-FAO Agricultural Outlook 2016-2025.

Although it appears that the level of total per capita consumption in developed countries has already been quenched, international agencies expect a growth of 4.6% from 2015 to 2025, which will come mainly from an increase in chicken consumption.

Figure 2.3. Total per capita consumption of meat and poultry,by level of development, in 2015 (in kg)



Source: OECD-FAO Agricultural Outlook 2016-2025.

Developing countries, which have lower intakes in absolute terms, are likely to have a total increase in meat consumption of 5.4% and 6.9% in poultry meat. As shown in Figure 2.3. above, there is a consumption gap between the type of countries and meat, indicating a great opportunity to grow poultry meat consumption.

Consumption differences are more marked when analysing some countries. For example, in the United States the inhabitants consume more than 95 kg of meat a year; in China,

50 kg and in India only 2.9 kg. The differences in consumption are based on factors such as income, habits, traditions and, in cases like Brazil, climatic conditions.[18]

Table 2.4. Per capita consumption of meat, selected countries, 2015 (in kg)

	USA	Brazil	India	China	European Union	Mexico	OECD countries
Cattle	24.8	24.2	0.5	3.8	11.6	8.8	14.0
Pork	22.7	11.2	0.2	31.6	27.8	11.5	23.2
Sheep	0.4	0.4	0.5	3.0	1.6	0.5	1.3
Poultry	47.6	39.4	1.7	11.6	22.8	26.3	28.6
Total	95.4	75.1	2.9	50.0	63.8	47.1	67.1

Source: OECD-FAO Agricultural Outlook 2016-2025.

The information indicates that the increase in meat production, as well as in per capita consumption, in developed and developing countries, albeit in different proportions, will continue in the coming years. This is also true for the tendency of poultry, particularly chicken, to become the most popular product.[19]

The growth in chicken consumption is explained by economic, nutritional and cultural reasons, but there has also been a change in preferences, related to the emergence of new alternatives for consumption of processed products.

Since the 1970s, poultry meat, particularly chicken, has been used to produce more and more goods such as sausages, nuggets and hams. On the other hand, the presentations of these products in small portions are more frequent. These trends are clear in developed countries, particularly in the United States, where in the 1960s 85% of the chicken was purchased whole, whereas in the last 5 years this form of consumption represents less than 10% of the total (Barbut, 2015). Now, in that country consumers show a preference for smaller portions, cuts and pieces without skin and bones. This situation impacts the place of sale of the products, in such a way that the modern channels acquire relevance. As will be seen later, in Mexico there has been no change in patterns of consumption such as the one occurring in the US market; however, it is possible that in the coming years there will be a shift, although perhaps slow, towards new modalities of consumption.

[18] An explanation of the impact of culture on meat consumption can be seen in Swatland, H.J., 2010, "Meat Products and Consumption Culture in the West", Meat Science, 86, p. 80-85, http://ssu.ac.ir/cms/fileadmin/user_upload/Mtahghighat/tfood/ARTICLES/meat/Meat_products_and_consumption_culture_in_the_East.pdf

[19] It is possible that the expansion in population in developing countries will cause a significant increase in production and consumption. Population increase towards 2025 can be of a magnitude of 1 000 million inhabitants. Africa and Asia may represent 85% of that increase. See Barbut (2015), p. 2-3 and 2-4.

Box 2.1. Chicken Production in India

In recent years, India has experienced a growth in chicken and corn production. The country has made an effort to overcome its lag in both products and has intensified the use of hybrids of corn of higher yield and nutritional quality to increase its production and to reduce the feeding cost of humans and birds.

India is experiencing a stage of growth in income and changes in consumer preferences. Its demand for meat is expected to increase by 55% between 1997 and 2020, of which chicken, for cultural and religious reasons, has the most promising future. In fact, India is the second largest Asian country in terms of poultry meat production, of which chicken represents more than 90%. In turn, poultry meat accounts for 51% of meat consumption.[1]

Although India maintains low levels of per capita consumption of meat and has a low productivity in corn, less than 3 tons per hectare, it is managing to increase production quickly. In 2003, India produced 1.6 million tons of poultry meat, which increased to 2.8 million tons in 2016. Regarding meat consumption, the country is expected to transit from a current level of about 3.1 kilograms per capita per year to 18 kilograms by 2050, of which 12.5 kilograms could be chicken. The productive effort is of great magnitude, since in terms per capita it means an increase of about 800%, in a country that has about 800 million inhabitants.[2]

To achieve growth, production has migrated to models of greater vertical co-ordination, although it is based on a fragmented production structure, since there are over 60,000 farms that raise birds. These farms represent more than 80% of the production, while the rest is given by backyard production.

The expansion of poultry meat production requires considerable effort to produce food, mainly corn and soy, since food represents the main cost of production. As in other countries, corn accounts for 60-65% of the feed, while soybean paste represents another 20%, to produce broilers.

The country increased its production of corn by 93% between 2000 and 2013. Soy production also increased, in the same period, by 126%, while number of birds increased by 142%.[3] It should be noted that the highest production of maize occurs in the southern part of the country, in areas near the centers of consumption to produce poultry.

The expansion of poultry meat production is an inclusive mechanism, which has a favorable impact on poverty reduction, the generation of direct employment on farms and processing activities and indirect effects on production of food, pharmaceuticals and equipment.

The increase in production has allowed the increase in consumption without an effect on imports, which are minimal. As the industry develops, India is expected to have an impact on the global export trade landscape and could affect production in the United States and Brazil.

One concern is that corn production lags behind the demand derived from poultry meat and egg production. If it does not increase its productivity, the country could become a net importer of corn by 2020. Hence, the efforts and investments being made in research and development to improve corn productivity using improved varieties.

There is concern about the protein content of corn. Therefore, experiments are being carried out with bio-fortified varieties (corn of protein quality or QPM and corn of high content of methionine or HMM), that allows the reduction of the supplementary use of synthetic amino acids, which have an impact on the costs of production. It is possible that these fortified varieties, whose use is still under study not only in India, but also in several countries, will allow the reduction of production costs between 3% and 5%.[4]

*Notes:*1. Hellin, J., V. Krishna; O. Erenstein and C. Boeber (2015), "India´s Poultry Revolution: Implications for Its Sustenance and the Global Poultry Trade", International Food and Agribusiness Management Review, 18, p. 152, available at https://www.ifama.org/resources/Documents/v18ia/Hellin-Krishna-Boeber.pdf

2. Idem, p. 153.

3. Idem, p. 155.

4. See Krishna, V., O. Erenstein, P. Sadashivappa and B. Vivek (2014), "Potential Economic Impact of Biofortified Maize in the Indian Poultry Sector", International Food and Agribusiness Management Review, 14(4), p. 111-40, https://www.ifama.org/resources/Documents/v17i4/Krishna-Erenstein.pdf

2.3. Poultry production by country

Table 2.5. Poultry meat production in the world, selected countries, 1995-2016 (millions of t)

	1995	2000	2005	2010	2016*	% total
US	13.8	16.4	18.6	19.3	21.0	18.2%
China	9.3	11.9	13.4	16.6	18.4	16.0%
EU	9.6	10.7	11.3	12.1	13.9	12.1%
Brazil	4.1	6.1	9.7	12.6	13.8	12.0%
Mexico	1.3	1.8	2.5	2.7	3.0	2.6%
Other countries	17.7	21.6	27.2	37.7	45.0	39.1%
OECD countries	28.9	33.9	38.3	41.3	46.9	40.7%
Total	55.7	68.5	82.7	101.0	115.2	

* Forecast.
Source: OECD-FAO Agricultural Outlook 2016-2025.

Three countries, the United States, China and Brazil, represent 46% of world production. Mexico represents 2.6% and has increased its share, albeit marginally.

2.4. International trade of poultry meat: exporters and importers

In 2016 worldwide, there was an international chicken meat trade of 11.9 million t. Of these, the United States and Brazil accounted for 7.4 million t, or 62%. The 28 countries that make up the European Union had exports of 1.4 million t, or 11.7% of the total. Thus, exports from these countries and territories account for almost 74% of world trade in poultry meat.

Table 2.6. Imports of poultry meat and trade account in 2016, selected countries (in thousands of t)

Country	Imports	Balance of trade
US	69.9	3,192.8
China	400.0	-3.0
EU	853.3	553.0
Brazil	3.0	4,159.5
Mexico	860.6	-856.2
OECD countries	2,846.2	2,610.5

* Forecast
Source: OECD-FAO Agricultural Outlook 2016-2025.

As shown in Table 2.6. above, Mexico has a deficit.[20]

2.5. Improvements in the productive process of poultry meat

The production of poultry meat has changed significantly over the last 50 years. The changes cover the areas of genetics, health, breeding practices, processing activities,

[20] It is important to note that the figures in the OECD-FAO database differ from those obtained from the SIAVI system of the Ministry of Economy. In the first case, imports represented 860.6 tt; in the second case, 780.6 tt are reported. In the subsequent chapters, in which it is not necessary to make an international comparison, the figures of the SIAVI system will be used.

logistical management and marketing. In the same way, new trends in consumption have emerged, in favour of value-added products.

The first notable aspect is the growth in bird size. In the case of chicken, in 1925, 112 days (16 weeks) of breeding were required to obtain animals weighing on average about 1 kg. The most recent data indicate that it currently takes nearly 7 weeks to obtain 2.8 kg animals.[21]

In addition to this, the productive efficiency, measured as the amount of food necessary to produce one kilogram of live animal, has been improved. This has been reduced from 4.7 kg of food in 1925 to 1.92 kg in 2010. Mortality has dropped almost 80% over the same period (Barbut, 2015).

2.6. Automation and use of technology

In addition to the improvements noted above, there has been a remarkable increase in automation and the use of technology in broiler production and processing. The effects have been most notable in the following:

1. The operation of farms, in which less food per kg of finalised product is used and there is a more rational use of energy to maintain the temperature.

2. The speed of the production line in the processing plants. In the United States, poultry processing capacity has increased 3.5 times since 1970. Also, since the 1990s, productivity per employee has increased by 50% (Barbut, 2015).

3. The amount of water used, particularly in countries that apply water-based cooling processes (United States) against those using air or spray (Europe).

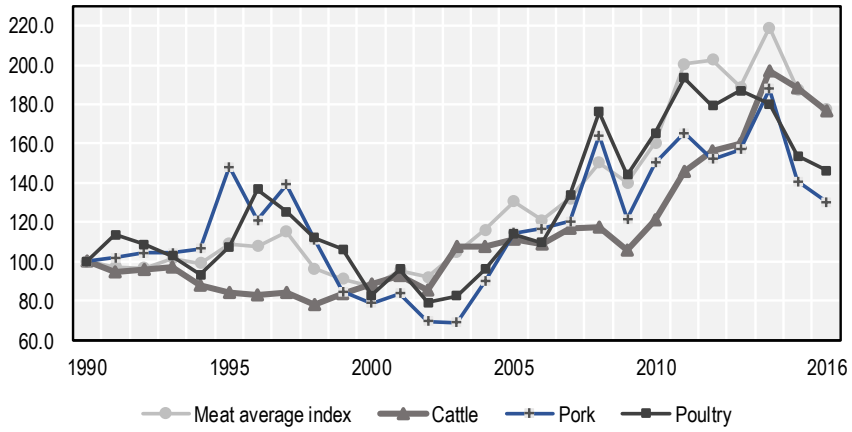
4. The application of more rigorous procedures for the phytosanitary control of production.

2.7. Evolution of prices

The changes in automation and the use of technology have impacted the prices of poultry in relation to other products. Figure 2.4. shows the evolution, between 1990 and 2016, of real international prices for beef, pork and poultry meat.

[21] The proportion of white meat, mainly breast, has gone from 15% to 23% of the total body weight of the animal. The same has happened with the proportion of meat, which went from 69% to 77% between 1997 and 2013, according to Barbut (2015), p. 2-9.

Figure 2.4. Evolution of international prices by type of meat, 1990-2016 (1990=100)



Source: OECD-FAO Agricultural Outlook 2016-2025.

The meat average index and that of beef increased at the same rate, 77%, while pork increased its price 30% and avian products 46%.

In relation to the price of one kg of beef, the price of poultry meat has decreased, since in 1990 one kg of poultry meat cost 38% of the cost of one kg of beef. In 2016, the ratio decreased to 31%. In the matter of pork, the effect was greater, with one kg of pork meat costing 65% of the price of one kg of beef in 1990 and in 2016 only 48%.

Table 2.7. Prices by type of meat, average in the world

	1990	2016
Cattle	2 793.5	4 938.9
Pork	1 828.6	2 381.3
Sheep	1 334.1	3 594.8
Poultry	1 076.7	1 574.3

Source: OECD-FAO Agricultural Outlook 2016-2025.

Although in relative terms the price of poultry meat increased relative to pork, the former is more competitive in absolute terms, since in 2016 one kg of poultry meat cost only 66% of one kg of pork meat.

It is noteworthy that all meat prices experienced significant increases since the mid-2000s, which coincides with a growth increase in the price of grain to feed animals.

2.8. Conclusions

Meat consumption has increased steadily over the past few decades. The main reasons are the increases in the population and in their level of income. As the purchasing level improves, consumers move from grain-based diets to ones in which meat consumption is higher.

Although the production of different types of meat has increased, chicken production and consumption have grown faster since the 1960s. It is expected that this trend will be

maintained due to: i) the price of this meat being lower than others; ii) the growth process of birds is faster than that of other species; iii) the productive process is more efficient, in use of land, water and food; iv) there is a favourable perception of the nutritional properties of chicken meat; and v) there are virtually no religious restrictions on their consumption. It is possible that consumption will increase more rapidly in low- and middle-income countries experiencing economic growth.

World production is concentrated in four regions: The United States, China, Brazil and the European Union, which together account for almost 60%. Mexico contributes 3% and has a deficit.

The use of technology has helped to increase productivity. This has led to a decline in relative prices, with respect to beef and pork. It has also made possible a decline in real prices during the 1990s. However, since the mid-2000s the prices of different types of meat have increased significantly, in parallel with the increase in the prices of cereals used as feed materials.

The relationship between meat production and consumption of grains has led countries such as India to plan to meet an increase in the demand for chicken meat over the next few years, by increasing their production and growing grains, mainly corn, to cover the feeding needs of the birds. In this way, meat demand would be served with domestic production, without generating external trade imbalances.

Chapter 3. Chain operation in the United States

3.1. General characteristics of the market

The US market probably represents the most analysed case, besides being the most developed market in terms of consumption of processed products and marketing through modern channels. It has a per capita consumption of 48 kg a year, which is one of the highest in the world. At the same time, it accounts for 18% of world production and 26% of exports (OECD-FAO, 2016).

In the United States, the concentration of the industry has increased. In 1991, the 4 largest producers accounted for 41% of the market; in 2009, they represented 53%. This concentration is probably higher in a local dimension, because the markets for the services offered by the farmers are in the areas surrounding the farms, where the food and processing plants are located (MacDonald and Key, 2012).

Economies of scale have been identified in processing plants, farms and food plants (MacDonald and Key, 2012). Transport costs (of food, chickens and mature birds) encourage the establishment of farms in places close to processing and food plants. However, there are limitations to geographic concentration due to biosafety and pollution risks.

Unlike the markets for cattle and pigs, where there are markets for live animals, in the case of poultry, market transactions are practically non-existent, as the production of poultry takes place under contract between the farmers and integrators.

The poultry industry has a greater capacity to adapt to changes in demand. This has allowed its rapid expansion. In the United States, between the mid-1970s and the mid-1990s, per capita consumption practically doubled, however, prices remained constant. It has also increased the use of chicken in the menus of fast-food restaurants.[22]

3.2. Vertical integration and contractual relations

The chain operates based on the vertical integration of the various links, with the particularity that poultry production is carried out by economic units belonging to third parties (farmers), under a contractual relationship with the integrators, who are companies that concentrate most of the activities that make up the rest of the chain.[23]

Farms provide manpower, capital and management services. Integrators deliver chick flocks to farmers, who receive as payment a base price and an incentive (positive or negative) that varies with their performance relative to other producers to which the

[22] Vukina (2001).

[23] Integrators are companies that provide inputs to the farms, follow up and are responsible for the sale of the poultry once its growth is complete.

integrators deliver flocks simultaneously. Farmers who deliver the largest amount of meat to the integrators (the most productive) in terms of inputs received (food and chicks) receive the highest incentive payments (Knoeber, 1989).

The main reason for the use of contracts with independent farmers is related to: i) the distribution of risks; ii) the transfer of technological progress and the dissemination of innovation; iii) consumer demand for uniform product quality; and iv) access to capital. The vertical integration performed by the integrators includes the reproduction of progenitor mothers, processing and distribution. The poultry production phase is not formally part of this vertical integration, although it is in fact unlikely that a farmer would provide his services to other integrators.

Farmers complain that they receive small payments compared to the profits obtained by integrators. As a result, there is an effort to regulate contracts for the production of poultry in several states of the United States and in federal legislation.

3.3. Design of contracts

Poultry production contracts are agreements between integrators and farmers, where the latter are obliged to care for the animals of the integrators until they reach a market weight in exchange for payment. These contracts have two main components: i) the allocation of responsibilities in the provision of inputs; and ii) the method for determining farmer compensation.

Integrators provide animals, food, vaccines, medicines and field staff, as well as training. Farmers provide the land, facilities (built and equipped according to specifications defined by the integrator), services, labour and operating expenses (maintenance, cleaning costs and disposal of waste, including dead animals) (Vukina, 2001). The trend is to require facilities with sealed chicken houses, with automated equipment to provide food and water to animals, as well as to control temperature conditions. Fuel costs may be the responsibility of either party or may be shared. Importantly, decisions about the frequency of rotation of the flocks correspond to the integrator.

The compensation system has different mechanisms. The most frequently-used model is a tournament scheme, with payment in two parts. On the one hand, it is a fixed payment per pound of meat produced. On the other hand, it is a bonus that the farmer gets if performance is better than the group average or a penalty if performance is below average. The existence of large integrating companies allows them to control the volatility of prices, which facilitates the use of tournaments.

The decision to choose between contracts and vertical integration depends on the need to adapt to uncertain conditions. Although the uncertainty would encourage vertical integration, the terms of the contracts have allowed the contractual scheme to be the predominant one. There are two reasons for this: i) the tournament compensation scheme provides a mechanism for technological adaptation without the need for contractual renegotiations and transfers production risks to the integrator; ii) requirements for farmers are to invest in chicken houses, ensure their performance, strengthen the long-term relationship and enable the operation of a scheme of self-selection of the most skilled farmers (Knoeber, 1989).

Through contracting, the integrator can offer neutral risk insurance covering common uncertainties in production, for example: climate effects, untested food mixes and the introduction of new genetic stock. However, the integrator does not provide full assurance

to farmers because the payment scheme cannot be independent of the results. This is a common situation in cases of moral hazard relationships. The farmers' obligation to make specific investments minimises the problem of opportunism, while tournaments provide a mechanism for relative performance evaluation. In this way, the problem of non-observability of the farmers' effort is solved (Vukina, 2001).

3.4. Opportunistic behaviour or commitment problem

Despite their benefits, production contracts can lead to a commitment problem. According to some authors, this situation occurs because of the concentration of the integrators in a local dimension, which could affect the investment decisions and farmers' incomes (Vukina and Leegomonchai, 2006).

The concept of the commitment problem or hold-up has its origin in theories that analyse transaction costs and the search for income, with the aim of explaining the organisation of companies. It was incorporated into contract theory to analyse situations of incomplete contracts in situations where there are recurring transactions between two parties (buyer and supplier) and specific investments are required. Since contracts cannot establish all future contingencies, the economic agent who did not make the investment in the specific assets has incentives to renegotiate the terms of the relationship. The agent who incurred the investment in assets (the supplier), has no alternative but to accept the conditions imposed by the counterpart. The result is that the supplier will be reluctant to invest because of the possibility of renegotiation of terms (Vukina and Leegomonchai, 2006).

Two factors affect the salvage value of the farmer´ investment: 1) the physical specificity of the investment, which means that the farmer makes investments according to the specific requirements of the integrator; 2) the specificity of the location, which means that the integrators could have monopsony power in each geographical area because the live birds cannot be transported long distance without loss. Both situations mean that the farmers' assets have a minimum value outside the industry, but also very low value outside the contract with the integrator. Thus, farmers' assets represent a source of potentially appropriable quasi-rents as they have a low salvage value outside the bilateral contractual relationship.[24]

The conclusion is that if farmers are aware of the risks of the relationship, they know that processors can appropriate quasi-rents, thus affecting the level of investment, which will be suboptimal over those that would result if instead of a contract there was vertical integration (Williamson, 1985).

The situation has been analysed by several authors. For example, Vukina and Leegomonchai (2006) did so from contract information from the national survey of broiler growers in the United States. The authors analyse two hypotheses: i) that the magnitude of the farmer's investment is positively related to the number of integrators hiring farmers' services in a given area; and ii) that the amount of farmers' investments is negatively related to the degree of specificity of the investment, where the potential effect is aggravated by the market power of the integrator.

[24] The theoretical development of these ideas can be seen in Klein, B., V. Crawford, and A. Alchian (1978), "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process", Journal of Law and Economics 21, available at https://business.illinois.edu/josephm/BA549_Fall%202014/Session%202/2_Klein_Crawford_Alchian%20(1978).pdf

The results indicated that there is evidence of a systematic relationship between the number of processors in each area and the number of farmers´ investments, measured as the number of chicken houses under contract. It was also determined that farmers tend to invest less in situations where asset specificity requirements are high and the number of integrators is small (Vukina and Leegomonchai, 2006).

On the other hand, Lewin-Solomons (2000) showed that farmers could be in a commitment problem. The author analyses the case in which there is idle capacity on the part of the farmers, in other words, not all of them are able to contract. In such a case, the integrators can force farmers to make investments in assets with high specificity. The author determined this from the evidence of the frequency with which the integrators required the farmers to make modifications and updates to the facilities and equipment. The risk of termination of the relationship, as well as the existence of idle capacity, induce the farmer to accept investments but also to accept lower income, particularly in monopsonic environments (Lewin-Solomons, 2000).

MacDonald and Key (2012) point out that the high concentration of integrators on the local market, the risks arising from the need to make significant investments in specific assets by the farmers, as well as the limited purchase commitments by the integrators, give the integrators market power in the poultry market. The author evaluates the impact of the concentration of local integrators on the remuneration to the farmers. The hypothesis is that when there is less competition among integrators payments received by farmers are lower.

Among the conclusions of the authors, it is found that: i) farmers with more modern facilities obtain higher incomes per pound; ii) farmers with longer-term contracts earn higher per-pound income; iii) farmers who did not mix antibiotics in the food and who followed plans according to the HACCP[25] also obtained higher per-pound income; iv) the degree of local concentration in the number of integrators, affects income, because when there is only one integrator, farmers receive 7% less income per pound and when there are only 2 or 3 integrators, the average income per pound is 4% lower, compared to more competitive structures (MacDonald and Key, 2012).

3.5. Conditions of access to capital

The industry has developed successfully due to access to capital. Despite the potential commitment problem, the contractual relationship between farmers and integrators has allowed a sharing in the cost of capital expansion. The farmer's investment is the quota for accessing a long-term relationship with an integrator, but also operates as a selection mechanism for farmers, according to their skills.

However, even though integrators offer some guidelines on their future demand for services, there are problems of evaluating the potential profitability of farmers' projects and their ability to pay their debts. In the granting of credit there is inadequate application of the financial instruments of evaluation, which has led to the failure of many projects (Dicks, 2010).[26]

[25] HACCP is a systematic preventive process to ensure food safety.

[26] The logic of financial operations in the case of loans for the operation of farms can be reviewed in Jenner, M. (2002), Understanding the Lender's Share of Grower Contract Pay, https://www.justice.gov/sites/default/files/atr/legacy/2010/12/08/AGW-00067-f.pdf. Some authors

3.6. Regulatory actions

Farmers argued that there is market power on the integrators´ side and that the contractual relationship with them creates disadvantages. They have said the following:

- The tournament system is unfair. Producers prefer a fixed performance standards scheme, which is used in the turkey industry. The composition of the group can be adverse and punish producers who would have a favourable evaluation in case of belonging to a different group.
- There is distrust in the equipment and methods to evaluate the weight of the food supplied and poultry at the end of the process.
- The contractual mechanism generates uncertainty about the renewal of contracts.
- There is a possibility of reprisals against farmers if they join producer organisations.
- There is manipulation on the part of the integrators in the quantity of delivered chicks (Vukina, 2001).

Concerning the above, the US Department of Agriculture's Grain Inspection, Packers and Stockyards Administration (GIPSA) issued in December 2016 The Farmer Fair Practices Rules to address the most harmful behaviours that affect farmers.[27] The Rules were under review during 2017.[28]

Regarding poultry, the authorities indicate that producers are vulnerable to market risks and concentration in the market, in a context in which the four largest processors control more than half the supply. Among other things, the proposed Rules indicate that it is not necessary for an unfair practice to harm the entire market to show evidence of a violation of the Packers and Stockyards Act.

The Rules propose to clarify the term "undue or unreasonable preference or advantage" and indicate practices of reprisal against free association and freedom of expression against producers who have demonstrated against the integrators´ behaviour.

Importantly, rules are proposed to establish the misuse of payment systems based on farmers' classification (tournament systems) used to force producers to compete based on factors controlled by the integrators.

3.7. Antibiotics

The use of antibiotics for growth promotion (AGPs) and disease prevention has become an integral part of the industry for several reasons (Teillant and Laxminarayan, 2015):

- At the level of animals: it improves the rate of growth and alimentary efficiency; decreases the mortality rate in the short term; more animal births are obtained per litter; the variability of the product is controlled;

even point out that in the long run the profitability of projects may be negative in real terms. See Taylor and Domina (2010).

[27] https://www.usda.gov/media/press-releases/2016/12/14/usda-announces-farmer-fair-practices-rules-clarifications-industry

[28] Documents can be consulted on https://www.gipsa.usda.gov/psp/farmerfairpractices.aspx

- At the farm level: input costs decrease; it improves the health status of animals in the long term; it reduces transmission of diseases, including those not prevented by antimicrobials (e.g. viral diseases, respiratory tract infections); and it reduces veterinary costs for disease care;
- At market level: it increases producers' incomes; increases consumer confidence and demand for products. The suppression of the use of AGPs can provide access to export markets, in which the use of the antibiotic has been used as an excuse to reject the product.

However, the use of AGPs poses potential risks to human health, since their application may increase the resistance from pathogens (such as those related to salmonella) to certain drugs (for example, fluoroquinolones). Some agencies such as the Centers for Disease Control and Prevention (CDC) recommend that antibiotics should only be used in food-producing animals under veterinary supervision for infectious diseases and not for growth promotion.[29]

The issue is considered of the greatest importance in the United States, and in 2014 the Presidential Advisory Council for Combating Antibiotic Resistant Bacteria was established. The Council is mandated to develop alternatives to antibiotics for agricultural use.[30]

3.8. Conclusions

The US market is a relevant case study because: i) it is the largest market in the world, with a high level of per capita consumption; ii) it is a highly technological market; iii) of its importance in marketing in the modern channel; iv) its consumption trends, in favour of value-added products. It is also a widely-studied market, particularly the relationship between integrators and farmers.

The market is characterised by an increase in concentration, which is most significant when measured locally. In this area, farmers must be in areas close to processing plants, which are controlled by the integrators. To exploit economies in rearing, feeding, and processing, it is important to reduce transportation costs.

The chain operates based on the co-ordination of several activities. The relationship between farms and integrators is one of the most relevant aspects. The relationship is regulated through contracts that specify the services that are provided by the farms. Farmers make investments financed by commercial banks to comply with the terms established in the contracts.

The contracts: i) specify the distribution of risks; ii) transmit technological progress and knowledge; iii) ensure a product of uniform quality; and iv) guarantee access to credit. However, for several years farmers have complained of low payments and the tournament system, where the integrators compete against other farms in terms of productivity. Tournaments allow integrators to establish a performance-based compensation system and solve the problem of observability of the farmers' effort.

Several studies have focused on the analysis of the relationship between farmers and integrators. Some authors agree in pointing out the existence of a commitment problem, due to: i) the specificity

[29] https://www.cdc.gov/narms/faq.html

[30] https://www.hhs.gov/ash/advisory-committees/paccarb/about-paccarb/charter/index.html

of the investments that farmers make; ii) the concentration that exists at the local level, which prevents farmers from having different options for contracting with integrators; and iii) the lack of a guarantee of renewal of contracts.

This means risks of renegotiation of contracts, which under conditions of perfect information would lead to a level of underinvestment on the part of the farmers. However, some studies indicate a certain myopia on the part of those farmers who do not have the ability to envisage future changes in the conditions of the market.

Chapter 4. Characteristics of the industry in Mexico

4.1. Meat production

In 2016 Mexico produced 6.45 million t of meat (beef, pork, sheep and goats, as well as poultry and turkey). Of these, poultry production accounted for 47.7%, beef 29.1% and pork 21.3%. Avian production includes chicken in its different presentations, as well as parent stock that has concluded its cycle of reproduction and laying hens that are replaced at the end of their productive period. The data is shown in Table 4.1.

Table 4.1. Production of meat in carcass in 201 (thousand t)

Product	Volume	Share %
Chicken*	3 077.9	47.7%
Cattle	1 879.3	29.1%
Pork	1 376.1	21.3%
Sheep	60.4	0.9%
Goat	39.5	0.6%
Turkey	16.8	0.3%
Total	6 449.9	

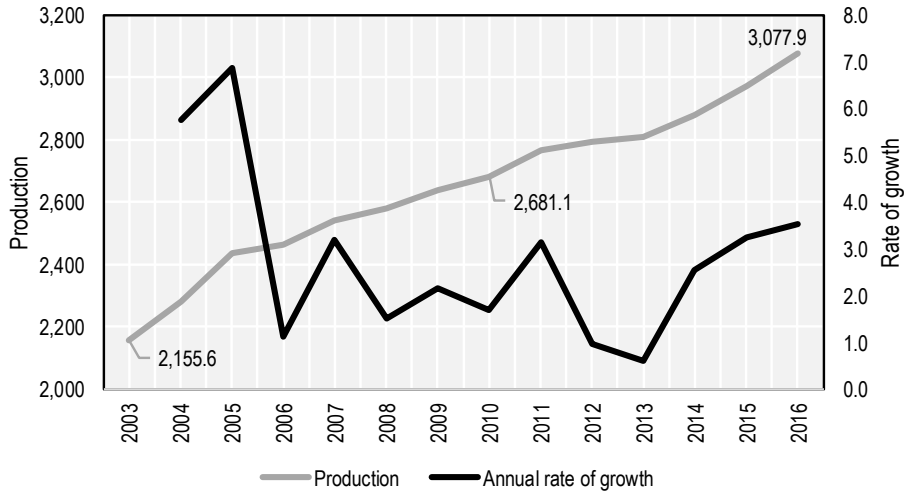
Note: * Includes poultry, and parent stock that has concluded its productive cycle and is sold as meat.
Source: SIAP

It should be noted that turkey production is minimal and the production of other avian species, for example duck, is practically non-existent. This means that sometimes the statistics of the industry do not distinguish between the production of all the avian varieties and those that includes only poultry.

4.2. Evolution of the production of chicken meat

Figure 4.1. shows the evolution of the total production of chicken meat, in the period 2003-2016. As can be seen, in 2003 the production was 2.1 million t. In 2016, production was almost 3.1 million t. That is, production grew 42.8% in that period, at an average annual growth rate of 2.8%.

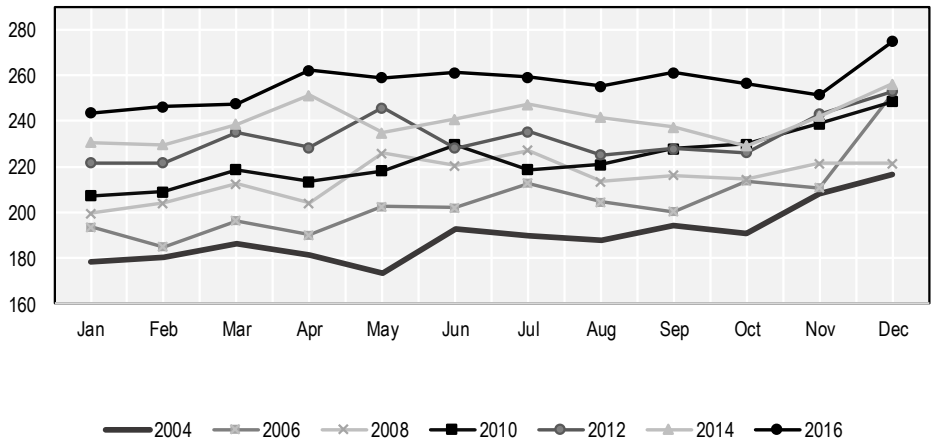
Figure 4.1. Production of chicken meat in Mexico, 2003-2016 (thousand t)



Source: SIAP

Figure 4.2. shows the evolution of monthly production in the same period. It is observed that production has consistently increased. It can also be seen that, in general, production reaches its minimum levels during the first quarter of each year, it has a stable level during the second and third trimesters and, at the end of each year, levels of production are higher, probably stimulated by the festivities of the season.

Figure 4.2. Monthly production of chicken meat, 2004-2016



Source: SIAP

4.3. Apparent consumption

The growth in domestic chicken meat production has not been sufficient to meet the growth of demand, which has led to an increase in imports of 140% between 2003 and 2016, when they reached 780 000 t. In terms of apparent consumption, imports went from being equivalent to 13% in 2003 to 20% in 2016. Meanwhile, exports are insignificant, accounting for less than 0.1% of domestic production.

Table 4.2. Apparent consumption of poultry (thousand t)

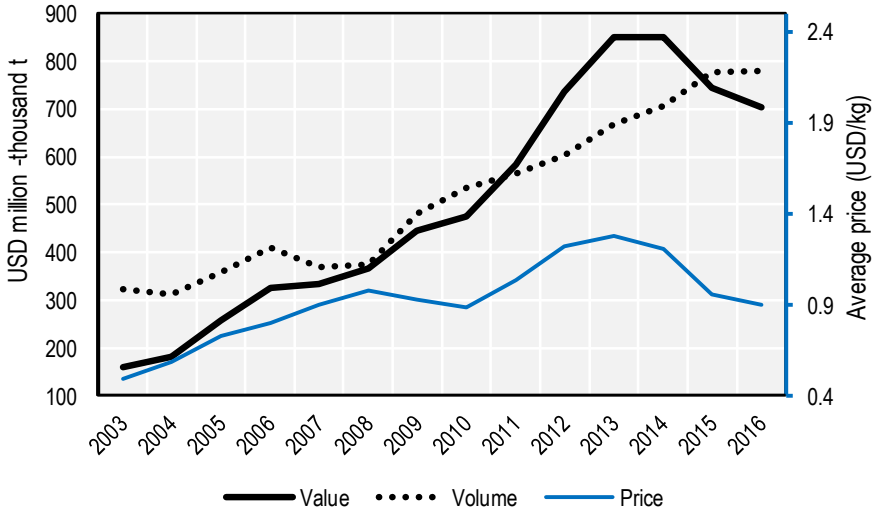
Year	National production	Imports (a)	Exports	Apparent consumption (b)	a/b
2003	2 155.6	323.2	1.3	2 477.6	13.0%
2004	2 279.8	310.9	0.3	2 590.4	12.0%
2005	2 436.5	357.3	0.2	2 793.6	12.8%
2006	2 463.8	410.4	0.0	2 874.1	14.3%
2007	2 542.5	370.2	0.3	2 912.3	12.7%
2008	2 580.8	374.3	1.7	2 953.4	12.7%
2009	2 636.5	480.5	5.6	3 111.4	15.4%
2010	2 681.1	535.7	10.6	3 206.2	16.7%
2011	2 765.0	564.3	13.5	3 315.9	17.0%
2012	2 791.6	603.5	4.3	3 390.8	17.8%
2013	2 808.0	667.5	3.9	3 471.7	19.2%
2014	2 879.6	706.5	7.4	3 578.6	19.7%
2015	2 973.0	777.0	2.2	3 747.7	20.7%
2016	3 077.9	780.6	2.0	3 856.5	20.2%

Source: SIAP and SIAVI.

4.4. Imports

As already noted, imports increased between 2003 and 2012. Figure 4.3. shows that they increased 140% in volume, going from 323.2 to 780.6 tt. In value, they grew from 158.6 to USD 703.6 million, or 343%. The figure also shows the evolution of the average price, which went from USD 0.49 to USD 0.9 per kg.[31]

Figure 4.3. Imports: value, volume and average price, 2003-2016



Source: SIAVI, http://www.economia-snci.gob.mx

[31] For the calculation of imports, tariff codes 02071303, 02071404, 02071301, 02071401, 02071101 and 02071201 were considered. Codes include meat, pasta and carcasses. Some of these products are used as inputs to prepare industrialised products, such as sausages.

By type of cut, in 2016 the legs and thighs represented 38.2% in value and 47.3% in volume; mechanically boneless imports accounted for 18.9% in value and 25.7% in volume and whole chickens, 0.5% in value and 0.4% in volume.

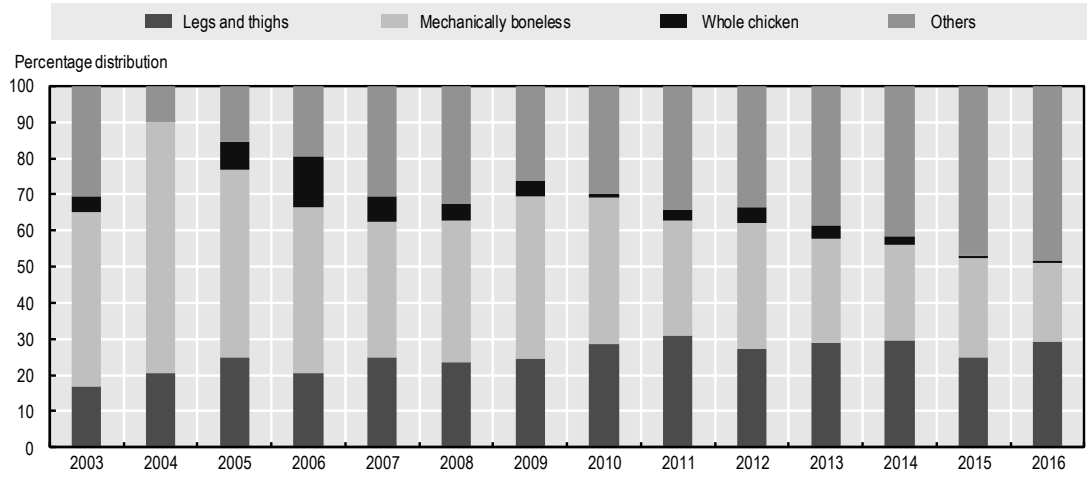
Table 4.3. Imports of chicken meat, 2016 USD million (md) and tt

	Tariff	Value		Volume	
Product	**code**	**(md)**	**% total**	**(tt)**	**% total**
Legs, thighs or legs attached to the thigh		**268.9**	**38.2%**	**368.8**	**47.3%**
Fresh or chilled	02071303	180.7	25.7%	255.6	32.7%
Frozen	02071404	88.2	12.5%	113.2	14.5%
Mechanically boneless		**132.9**	**18.9%**	**200.5**	**25.7%**
Fresh or chilled	02071301	97.5	13.9%	175.4	22.5%
Frozen	02071401	35.4	5.0%	25.1	3.2%
Whole chicken		**3.7**	**0.5%**	**2.9**	**0.4%**
Fresh or chilled	02071101	3.0	0.4%	2.4	0.3%
Frozen	02071201	0.7	0.1%	0.5	0.1%
Others		**298.1**	**42.4%**	**208.3**	**26.7%**
Total		**703.6**		**780.6**	

Source: SIAVI, http://www.economia-snci.gob.mx.

Figure 4.4. below shows that between 2003 and 2016, the proportion of imports corresponding to leg and thigh increased in value, while the proportion corresponding to mechanically boneless was reduced.

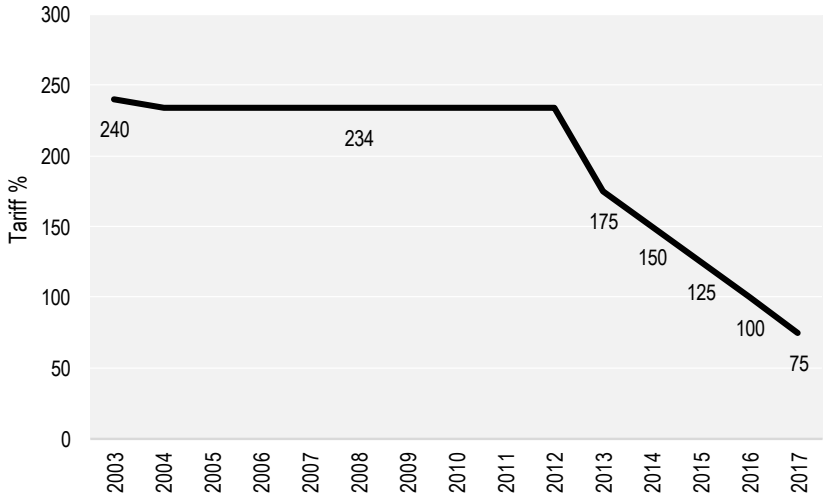
Figure 4.4. Imports of chicken meat, without chopping and in pieces, 2003-2016, percentage distribution, value of imports



Source: SIAVI, http://www.economia-snci.gob.mx.

Regarding import tariffs, the following figure shows their evolution since 2003. These tariffs are applicable to the different categories in which the importation of chicken meat is classified, except for livers, whose applied tariff was 10%.

Figure 4.5. Import tariffs, 2003-2017



Source: SIAVI

It can be observed that the tariff applicable to countries with which there is no free trade agreement, has decreased from 240% to 75%, between 2003 and 2017. It is worth noting the persistence of high tariffs, even though the comparison of prices of chicken meat in different countries of the Americas by the OECD indicates that prices in the United States and Mexico are the lowest. Consequently, it is possible that carcass prices are also lower. In this way, tariff protection is applied to products that come from countries where the costs are higher (OECD, 2018).

There is a tariff-rate quota on imports, which dates from 2013 and was modified in December 2017, to be valid as of December 31, 2019. The tariff-rate quota allows the import of up to 300 000 t of fresh or frozen meat free of charge of tariff (Secretaría de Economía, 2017).

In addition to importing meat, the country imports fertile eggs, which are used to obtain breeding stock as well as day-old chicks. Before 2012 imports were practically non-existent. Since that year, they have been increasing in value and volume, to represent USD 150 million and more than 40 000 t in 2016.[32]

Table 4.4. Imports of fertile eggs, 2012-2016

	Value	Volume
Year	md	t
2012	39.0	9 854.5
2013	110.3	22 905.8
2014	128.3	29 834.2
2015	147.7	38 346.9
2016	150.3	40 430.1

Note: 2012 includes tariff code 04070003.
Source: SIAVI

[32] The statistics do not distinguish between fertile eggs for meat or egg production.

Some interviewees attribute this phenomenon to health emergency situations that have occurred in the country, which have led some companies to move the operation of broiler breeder farms to the United States.

Imports of fertile eggs are exempt of tariffs. However, the interviewees pointed out that when there are outbreaks in the countries of origin, import is hampered, which affects the national supply of meat. It is worth mentioning that almost 99% of imports came from the United States in 2016. The rest came from Brazil, Canada and Spain.

According to the information, fertile eggs had an average price of USD 3.7 per kg in 2016. For comparison purposes only, eggs imported for human consumption had an average price of $ USD 0.75 per kg.

4.5. Chicken meat production by state

National production is highly concentrated in certain federative entities. Five states−Jalisco, Veracruz, Aguascalientes, Querétaro and Durango−represent 51% of production; 90% is generated in 15 entities.

Between 2003 and 2016 the country increased production by 922 000 t. Two-thirds of that increase comes from five states:

- Aguascalientes is the state that has shown the greatest growth, expanding its production by 200 000 t per year. The state practically doubled its participation in national production, from 5.6% in 2003 to 10.5% in 2016, as the production growth rate was 7.8% per year.
- In the same period, Jalisco increased its production by 132 000 t. Its share of domestic production increased from 10.8 to 11.8% and had a growth rate of 3.5% per year.
- Veracruz increased production by 104 000 t, although its share only increased in 0.2%. It had an annual growth rate of 2.9%, just above the national average.
- Durango increased its share of total production by 0.9%, expanding production by 103 000 t and had a growth rate of 3.6%.
- Querétaro declined slightly in its share of domestic production by 0.1%, however, it increased its production by 83 000 t and grew annually by 2.7%, below the national average.

Table 4.5. Production of chicken meat by state, 2003-2016

	Production		Production		Rate of growth
State	2003	% total	2016	% total	2003-2016
Jalisco	232.5	10.78%	364.5	11.84%	3.5%
Veracruz	228.3	10.59%	332.8	10.81%	2.9%
Aguascalientes	121.9	5.65%	322.0	10.46%	7.8%
Querétaro	202.2	9.38%	285.7	9.28%	2.7%
Durango	178.3	8.27%	281.5	9.15%	3.6%
Guanajuato	134.0	6.21%	205.8	6.69%	3.4%
Puebla	156.1	7.24%	173.3	5.63%	0.8%
Chiapas	85.8	3.98%	166.7	5.41%	5.2%
Yucatan	76.4	3.54%	131.3	4.27%	4.3%
Sinaloa	86.6	4.02%	129.6	4.21%	3.2%

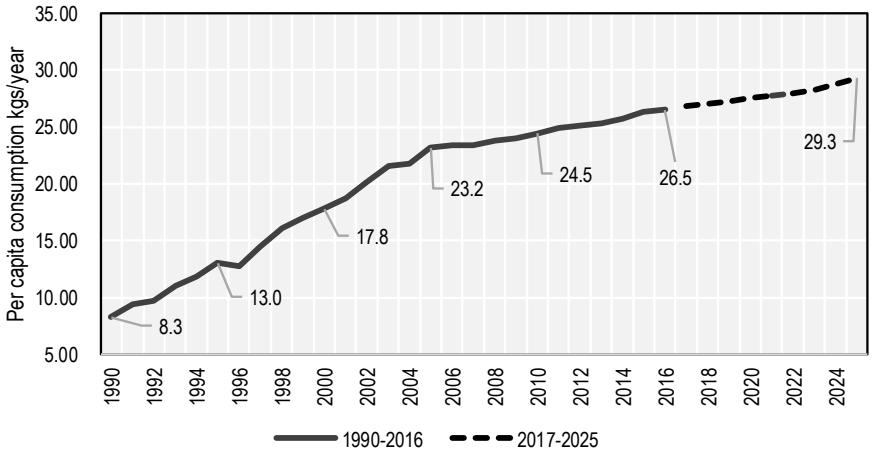
Estado de México	112.7	5.23%	103.4	3.36%	-0.7%
Coahuila	105.0	4.87%	84.8	2.75%	-1.6%
San Luis Potosí	61.6	2.86%	84.4	2.74%	2.5%
Nuevo León	111.5	5.17%	82.3	2.67%	-2.3%
Hidalgo	57.5	2.67%	66.5	2.16%	1.1%
Michoacán	44.3	2.05%	55.1	1.79%	1.7%
Morelos	46.0	2.13%	54.3	1.76%	1.3%
Sonora	4.9	0.23%	33.2	1.08%	15.8%
Nayarit	25.6	1.19%	29.3	0.95%	1.0%
Tabasco	23.6	1.09%	22.2	0.72%	-0.4%
Campeche	8.6	0.40%	21.1	0.69%	7.2%
Oaxaca	7.9	0.36%	12.0	0.39%	3.3%
Guerrero	13.4	0.62%	11.4	0.37%	-1.2%
Colima	13.5	0.63%	11.3	0.37%	-1.4%
Quintana Roo	3.6	0.17%	4.0	0.13%	0.9%
Zacatecas	2.6	0.12%	3.4	0.11%	2.1%
Chihuahua	7.5	0.35%	3.3	0.11%	-6.2%
Baja California	1.0	0.05%	0.9	0.03%	-0.7%
Tlaxcala	0.8	0.04%	0.8	0.02%	-0.6%
Baja California Sur	0.3	0.02%	0.7	0.02%	5.9%
Tamaulipas	1.0	0.05%	0.3	0.01%	-8.8%
Ciudad de México	0.8	0.04%	0.1	0.00%	-18.2%
Total	**2 155.6**		**3 077.9**		**2.8%**

Note: * Includes poultry, and parent stock that has concluded its productive cycle and is sold as meat.
Source: SIAP

4.6. Per capita consumption

Average annual consumption has increased. Since 1990, it has gone from 8.3 to 26.5 kg per person, that is, it has increased practically three times.[33]

Figure 4.6. Per capita consumption, real and projected, 1990-2025 (kg/yr)



Source: OECD-FAO Agricultural Outlook 2016-2025.

[33] As already indicated, the figures from the ENIGH indicate higher per capita consumption levels, of around 29 kg per year in 2016.

Projections made by the OECD and the FAO indicate that consumption will continue to increase, probably to reach 29.3 kg per person by 2025, that is, an additional 10%. It should be noted that the National Population Council estimates that in 2016 there were 122.2 million inhabitants and that in 2025 there will be 132.5 million, which means an additional 10.3 million.34 Given the forecast per capita consumption, the probable scenario indicates that in 2025 consumption will increase by 650 000 t from the current level. This is equivalent to almost 20% of production in 2016. If this scenario occurs, there will be a need to expand the supply, that is, production and imports, which will generate a greater demand for grain to feed the birds.

4.7. Conclusions

In Mexico, the production of chicken meat represents almost half of the total meat market. The chicken meat market has expanded at a rate of 2.8% since 2003. However, production growth has not been enough to meet demand, with import value growing 140% since 2003 and accounting for 20% of apparent consumption. Almost 50% of imports are of pieces, primarily leg and thigh and come mainly from the United States.

There is significant tariff protection for countries with which no trade agreements exist. Between 2003 and 2012 the tariff was 234% and since then it has been reduced to 75% which is the current rate, with the exception of chicken livers. At the moment, there are no proposal to decrease it further.

Fertile eggs are a fundamental input to produce chicken meat on a large scale. The country has increased its imports by about 500% since 2012. Some interviewees have pointed out that this is due to the decline in domestic production caused by health emergency crises in the past.

At the federative level, the states that account for most of the production are Jalisco, Veracruz, Aguascalientes, Querétaro and Durango, which account for 51% of the supply.

Per capita consumption has increased significantly. It tripled since the beginning of the 1990s and is currently 26.5 kg per year. Projections indicate a possible 10% growth by 2025. This, coupled with population growth, could result in an increase in apparent consumption of around 20%, which should be addressed through increased production or imports.

[34] Consejo Nacional de Población, http://www.conapo.gob.mx/es/CONAPO/Proyecciones_Datos

Chapter 5. Provision of day-old chicks

5.1. A brief history

Poultry are domesticated birds for providing eggs and meat for human consumption. Chicken is the most common variety, followed by turkey and duck, varieties that have a smaller presence in the Mexican market.

Early efforts to produce varieties of chicken through genetic experimentation took place on farms in the 1920s. In those years birds were produced with the double purpose of obtaining meat and eggs. However, since the 1950s the activity specialises in the production of broilers (from the genetic cross of Cornish and White Plymouth Rock varieties) and laying hens (from the Leghorn variety). The reason for the specialisation is that laying hens do not have the desired growth for meat production, and vice versa.[35]

Since then, companies have specialised in the production of the genetic varieties used in the industry. The companies started their operations based on statistical analysis applied to genetic techniques such as the use of hybridisation tools, techniques for the identification of blood types and the use of feathers to identify the sex of animals, among other aspects.

Companies focus on specific characteristics of chickens (meat yield, growth times, feed efficiency, fat content and others) and for hens (fertility, productivity in laying). The preference in the United States for the consumption of white meat (breast) in relation to the dark parts (leg, rump and thigh) has led companies to develop large-breasted varieties.

Consolidation of the industry began in the 1960s, which led to the current market being supplied by a few companies. They have chosen to focus on the process for obtaining day-old chicks or fertile eggs and are not vertically integrated with the operation of broiler farms or processing facilities.[36]

5.2. Business model

The hybrids are the result of the mixing of genetic lines, resulting in a new generation that integrates some characteristics of the original lines, but also has unique characteristics.

The objective is to obtain hybrids with improved characteristics with respect to their parents – for example, in relation to strength, animal health or speed of growth. The breeding seeks to improve the average of the characteristics, but also seeks the uniformity of the flocks. The product obtained by the breeding companies is used for internal reproduction or by breeding farms owned by integrators.

[35] For more information see Elfick, D. (sf), "A Brief History of Broiler Selection: How Chicken Became a Global Food Phenomenon in 50 Years", available at http://cn.aviagen.com/assets/Sustainability/50-Years-of-Selection-Article-final.pdf

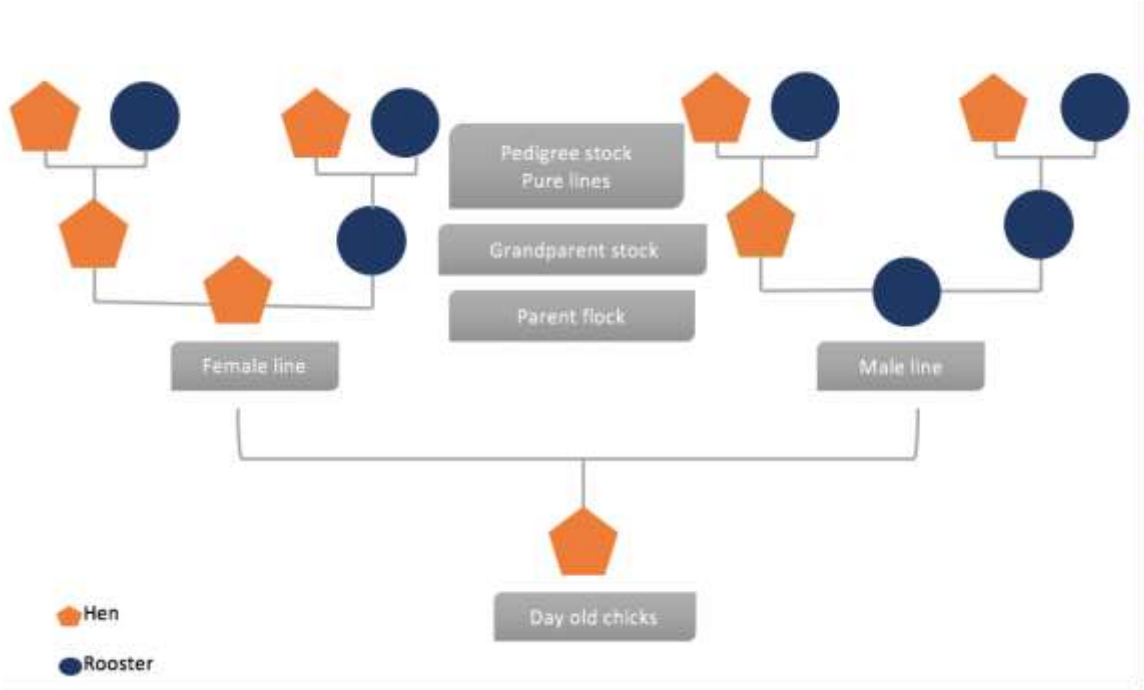
[36] Although Cobb-Vantress is a joint venture involving Tyson Foods.

The process of multiplication begins with the pure lines of offspring or pedigree, which are the result of the reproduction and upbringing of a population for several generations, in a process that takes years. During this period, individuals cannot be crossed with others belonging to a distinct population. Some pure lines could be heirs of those developed in the 1940s or 1950s. Pure lines are a highly protected industrial secret, as they constitute the competitive advantage of companies.

From the pure lines a process of hybridisation takes place, leading to the production of four generations of birds: great-grandparents, grandparents, parents or breeding birds and commercial birds. Commercial flocks are crosses of pedigree lines, which inherit desired characteristics. Parallel to the production of commercial bird flocks, companies maintain experimental lines that allow them to develop new types of birds.

The following figure illustrates the process:[37]

Figure 5.1. Poultry integration



Source: Add the source here. If you do not need a source, please delete this line.

To obtain day-old chicks, there is hybridisation at the level of the great-grandmothers taking four pairs from pure lines, two corresponding to the female line and two of the male line. From the hybridisation of each of the four pairs, descendants are obtained. These are hybridised, in two pairs. This hybridisation occurs at the level of progenitor grandmothers and from it two descendants are obtained, one for each line. Reproductive mothers, in the case of meat, are known as heavy breeder hens, and in the case of the egg industry, they

[37] For more information see http://www.poultryscience.uark.edu/Poultry_Genetics

are called egg-laying breeders. From hybridisation at the breeder level, you get the fertile egg, which is the egg from which a day-old chick is born.

The process is repeated and has a multiplier effect. If it is considered that a hen can lay more than 300 eggs in a year, then the previous figure gives rise to a reproductive pyramid, which can have at its base up to more than 100 000 descendants. The animals that make up this structure are renewed as their fertile life is exhausted.

For integrators or independent farms, it is technically feasible to reproduce hybrids based on day-old chicks or fertile eggs. However, this type of reproduction would produce less efficient flocks, because generationally there is a deterioration in the performance of the animals. For this reason, integrators who have breeding farms must renew parent stock.

Fertile eggs are sent to incubators, to obtain day-old chicks. The incubators can be owned by the primary breeding company, so that they can market the chick to the farms or to the integrators. The companies of primary education may also market the fertile egg, so that it is used by the integrators to obtain the chick for fattening in their incubators. The fertile egg is a value-added product, which has a higher value than the processed egg.

It is also possible for breeding companies to provide the elements for integrators to operate their own breeding farms. That is, some integrators can access parent stock or fertile eggs. These farms have characteristics different from poultry farms, since a greater control of phytosanitary aspects is required.

Heavy breeders require between 16 and 18 weeks from birth to begin fertile egg laying. The laying period may last until the breeder reaches 76 weeks of age.

The fertile eggs require care. Their transfer from breeding farms to incubators is usually done in special vehicles with temperature control. The product must be fumigated. Once in the incubator, it takes 21 days until the birds are born.

5.3. Participants in the industry

In Mexico three genetic lines of day-old chickens are used, each belonging to a transnational company. These three companies are virtually the only ones that have survived in the mass market.[38]

[38] The corresponding Herfindahl-Hirschman index is 6 522 points, which is the reflection of a highly concentrated structure. The "Technical Criteria for the Calculation and Application of a Quantitative Index to Measure Market Concentration" of COFECE, point out that in the analysis of concentrations, if the Herfindahl-Hirschman index is below 2 000 points after the transaction, the agency considers that it is unlikely that this will cause a decline in competition. The same happens if the index is between 2 000 and 2 500 points, the change in the index as a result of the operation is between 100 and 150 points and the resulting company is not one of the four largest in the market. See Diario Oficial de la Federación, 14 de mayo de 2015, http://www.dof.gob.mx/nota_detalle.php?codigo=5392185&fecha=14/05/2015

Table 5.1. Genetic lines of day-old chicks

Company	Brand	Share %
Aviagen	Ross	79%
Cobb-Vantress	Cobb	16%
Groupe Grimaud	Hubbard	5%

Source: UNA (2016), Compendio de indicadores económicos del sector avícola.

The dominant brand is Ross, belonging to Aviagen. The company specialises in providing chicks from the breeding grandparent level in more than 100 countries through the Arbor Acres®, Indian River® and Ross® brands. The Ross brand is the most widely used chicken meat production in the world. In the case of Mexico, the company's website announces Bachoco as its distributor.[39]

Cobb-Vantress is the company that owns the Cobb brand. The origin of the company dates back to a farm in 1916. The company is a joint venture in which Tyson Foods, one of the most important integrators in the international market, participates. The website indicates the existence of two distributors in Mexico: Bachoco and Buenaventura Grupo Pecuario.[40]

Finally, the Hubbard brand belongs to Groupe Grimaud, which has its origins in 1921. The company supplies breeding grandparents and day-old breeding stock. The group is the second largest company in the world in multi-species genetic selection.

5.4. Barriers to entry

The supply is made up of a few producers, all transnational companies. To access the market, it is necessary to develop pure genetic lines or pedigree, which takes considerable time.

According to some interviewees, the activity requires significant research and investment, as well as special phytosanitary care. The business is highly sensitive to diseases such as Newcastle, Avian Influenza and others, which can affect the productive process and significantly harm the companies' finances.

The stock of birds is relatively small; however, it is of high value, which justifies the application of high levels of biosecurity, and involves high costs.[41]

Breeding companies could choose to market their products in any of the links indicated in Figure 5.1. However, they have incentives to care for the genetic lines, so that, at least in the case of Mexico, they do not follow the practice of granting to third parties the management of great-grandmothers. The management of breeding grandmothers is reserved for some national companies that show the ability to control risks as well as an economic capacity. It is more common for domestic producers to have access to reproductive mothers. Small companies can only acquire day-old chicks or fertile eggs to produce day-old chicks, according to what has been pointed out by some interviewees. In this way, breeding companies protect themselves from the possibility that some integrator or farmer can reproduce pedigree lines.

[39] See http://en.aviagen.com/brands/ross/distributors

[40] See http://www.cobb-vantress.com/about-cobb/distributors

[41] See The Structure of the United Kingdom Poultry Industry (2006), available at http://labourproviders.org.uk/wp-content/uploads/2012/11/Poultry_sector.pdf

5.5. Substitution

Due to its characteristics, day-old chicks or fertile eggs offered by primary breeding companies cannot be substituted by poultry farms or integrators that operate the process of production of industrialised meat, since the producers need to maximise the quantity of product obtained and to standardise the production, characteristics that can only be obtained using day-old chicks from breeders applying genetic improvement techniques. However, there is a range of farms and small processors that could use hybrid varieties from other sources, although the available information does not allow identification or quantification of this practice.

Regarding possible supply-side substitution, the facilities of the farmers and integrators involved in the production of meat could not be used for primary breeding activities. On the other hand, the facilities of the primary breeders could not be used for alternative uses, as they are specific to the primary breeding activity. In addition, most of the activities take place outside of Mexico.

5.6. Conclusions

The industrial production of chicken meat requires the permanent and synchronised supply of large volumes of fertile egg to the incubators and day-old chicks to the farms. Behind the provision of these inputs there are three transnational companies that have been producing genetic varieties for several decades, based on statistical analysis, the use of hybridisation tools, techniques for identifying blood types and other procedures. This activity requires significant investment and special care to avoid health risks.

The business model of these companies is based on obtaining pure lines, from which four generations of birds are obtained: great-grandmothers, grandmothers, mothers or breeders and commercial birds. Genetics or primary breeding companies supply fertile eggs or day-old chicks to integrators and poultry farms. Integrators can operate breeding farms, with inputs provided by genetics companies. For cost, health care, and business model reasons, genetics companies facilitate the installation of breeding farms only to those integrators who operate on a large scale.

Day-old chicks or fertile egg from genetics companies do not have substitutes, considering their consumers are looking for special characteristics that maximise yields and obtain a homogeneous product.

The available information does not allow the determination of whether there is unrestricted access to fertile eggs or day-old chicks coming from genetics companies for all participants in the production of chicken meat. Apparently large integrators have access to inputs, however, there is no information documenting whether that happens with independent farms. Some interviewees suggested that it is possible that providers give preference to access to larger customers when there is high demand.

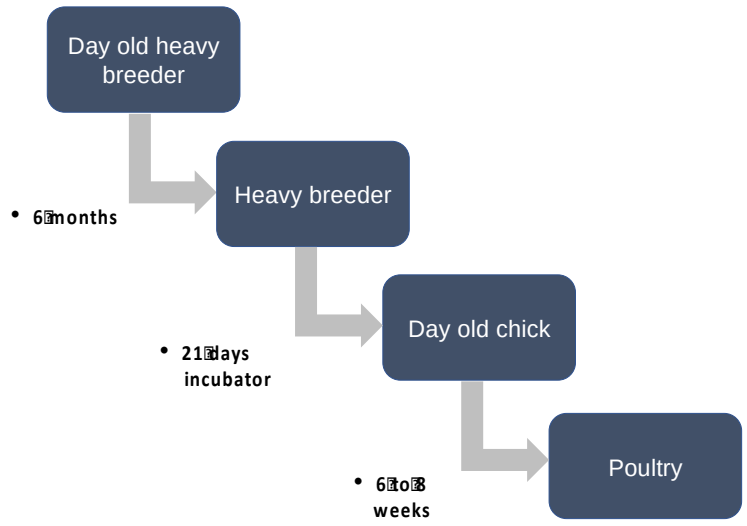
Chapter 6. Production of poultry

6.1. Productive cycle

The trend in the production of chicken meat is automation and mechanisation in all the stages, including: the supply of chickens, the logistical management of live animals (delivery to the farms, transportation and unloading in processing facilities), stunting, bleeding, feathering, electrical stimulation, evisceration, inspection, refrigeration, ripening, slicing, packaging, packaging and distribution.

The market demands an increasingly uniform product. This is achieved through the use of technology, with large-scale operation. The vertically integrated companies that supply the market obtain heavy breeding chicks, which grow for a period of about six months, to become breeding hens. From these, the fertile egg is obtained, which is incubated for 21 days, to obtain day-old chicks, which are delivered to production farms. These facilities may belong to the same company or may belong to third parties and operate under a contractual scheme, to take care of growth for about 6-8 weeks, to obtain poultry that goes to market.

Figure 6.1. Productive cycle of poultry



6.2. Heavy breeding farms

Day-old chicks come from broiler breeder farms in which the parental stock produces fertilised eggs. The use of chicks from controlled genetic lines is essential to guarantee the homogeneity of the product and the achievement of the desired characteristics. Chicks are

a relevant component of meat production costs, accounting for about 15% of the total production cost.[42]

There are two production lines in the industry. The laying line, which is used for the market of commercial egg production and the heavy line, which is used for the meat market. The genetic lines that give rise to laying and heavy breeders are different. Meat companies have specialised farms in heavy-breeding stock. The fertile egg obtained from them cannot be marketed for human consumption.

The heavy-breeding activity is divided into two two stages.[43] In the first one, the companies receive the one-day heavy breeding hen. At this stage, the care of the animals takes place until their growth with reproductive pathways takes place.

In the second stage, the animals are transferred to the facilities that operate as breeding areas, where heavy breeders produce the fertile egg, from which day-old chicks for production are obtained. Heavy breeders have productive cycles that last from 34 to 40 weeks. During its productive life, a heavy breeder can produce between 150 and 180 units of fertile egg.[44]

6.3. Incubation

Incubation takes 21 days. The process begins with the placement of the fertile egg in an incubator, which is a device that simulates the natural incubation process of the birds. The equipment provides adequate conditions of temperature and humidity to allow the bird to be born. Modern equipment is installed in rooms where there is a corridor and, on the sides there are shelves where they lay eggs.

After 18 days, the eggs are transferred to hatchers, where the process is completed, and the chicks are born.

Once the birth takes place, the animals are removed, inspected, vaccinated, classified and placed in boxes to be mobilised to production farms on the same day. In these farms the birds are provided with care for their growth and subsequent processing.

6.4. Characteristics of production farms

The location of the farm is the first element to consider for its installation. In general terms, a property located in a confined area is required. The eligibility criteria for the facility are based on three elements:

- Legal: The property must be free of legal litigation. Some interviewees pointed out that this aspect is fundamental, because in Mexico there is a great deal of litigation about land tenure, accompanied by a legal system that hinders the full enjoyment of property rights, which generates uncertainty and can affect investment.
- Engineering: The land must be flat, to have water and an electrical infrastructure.
- Sanitary: The installations must be located at a short distance from other productive units.

[42] See https://bachoco.com.mx/el-principio-del-sabor/procesos-del-pollo/

[43] For a detailed description of the process, see http://www.poultryhub.org/production/industry-structure-and-organisations/poultry-breeding/breeder-farm-sequence/

[44] See The Structure of the United Kingdom Poultry Industry (2006).

In the 1990s, several standards were established to combat avian salmonellosis, Newcastle disease and avian influenza, where regulations were instituted for distances involving farms, distance from other farms, incubators, food factories, human settlements, processing of chicken manure and its areas of use.[45]

In 2011, an agreement was issued for the fight against avian influenza, which also established new provisions regarding distances.[46] The agreement established that the location of the farms should allow their sanitary isolation and should not be exposed to prevailing winds. They must be away from sources of risk such as food plants, slaughterhouses, garbage dumps, poultry production facilities or other animal species and human settlement areas. There must be a distance of at least five kilometers between farms and incubation facilities.[47] The distances can be modified, based on the winds, topography and epidemiological factors. Chicken houses should be oriented from east to west, and should allow the air to flow through the windows and prevent direct sunlight from entering. For processing or sifting of manure facilities, they must be located at a minimum distance of five kilometers in relation to other poultry farms and at least one kilometer from the edge of federal or main roads (SAGARPA, 2011).

In practice, the agreement replaced the provisions of the Official Rules concerning avian salmonellosis and Newcastle disease, although these were later cancelled. According to some interviewees, this has led to confusion about the applicable provisions and has led to a lack of co-ordination between different levels of government, which encourages authorities to apply criteria that are different from those contained in federal regulations. They also pointed out that regulation through agreements reduces the possibility of enforcement and sanction.

[45] NOM-005-ZOO-1993, Campaña Nacional contra la Salmonelosis Aviar; NOM-013-ZOO-1994, Campaña Nacional contra la Enfermedad de Newcastle presentación Velogénica and NOM-044-ZOO-1995, Campaña Nacional contra la Influenza Aviar. The first two were canceled in 2014 and 2015, respectively. The last one was canceled in 2011.

[46] SAGARPA (2011a), "Acuerdo por el que se da a conocer la campaña y las medidas zoosanitarias que deberán aplicarse para el diagnóstico, prevención, control y erradicación de la Influenza Aviar Notificable, en las zonas del territorio de los Estados Unidos Mexicanos en las que se encuentre presente esa enfermedad", DOF, 21 de junio de 2011, available at http://www.gob.mx/cms/uploads/attachment/file/108846/AcuerdoIA_21jun11__1_.pdf

These agreements are issued under Article 78 of the Federal Animal Health Law, which states that: "In case of detection or scientific evidence of the presence or imminent occurrence of exotic and notifiable diseases and pests of mandatory notice, eradicated, unknown or inexistent in the country that put a zoo sanitary emergency to one or more species or populations of animals in all or part of the national territory, or where the number of expected cases in an endemic disease is exceeded, the Ministry shall activate, integrate and will operate the National Animal Health Emergency Provisions that will involve immediate publication by agreement in the Official Gazette of the Federation and, if applicable, will issue the animal health provisions, which establish the prevention, control and eradication measures to be applied to the particular case". SAGARPA (2007), Ley Federal de Sanidad Animal, DOF, 25 de julio de 2007, available at http://www.gob.mx/cms/uploads/attachment/file/118761/LFSA.pdf

[47] See article 47 of Agreement, SAGARPA (2011a) and SAGARPA (2009), Manual de buenas prácticas pecuarias en unidades de producción de pollo de engorda, http://una.org.mx/english/images/yootheme/Documentos/Manuales/manualpollosengorda.pdf

Box 6.1. Avian influenza and its economic impact

Avian influenza is a highly contagious viral disease that affects several species of birds consumed by humans (chickens, turkeys, quail, etc.), as well as wild birds. Mammals, including humans, can occasionally contract the disease. Outbreaks of avian influenza virus are not a recent phenomenon. There are numerous descriptions of outbreaks of avian influenza in different times and regions of the world.

Although there are several strains of the virus, in general terms they can be classified into two categories: low pathogenicity avian influenza (LPAI), which usually causes a mild disease, often unnoticed or without any symptoms; and high pathogenicity avian influenza (HPAI) that causes severe clinical signs and high mortality rates in birds. The appearance of new strains of the virus is possible.

According to the World Organization for Animal Health (OIE), natural viruses of influenza A type of high pathogenicity that produce acute clinical disease in economically important birds, have only been associated with subtypes H5 and H7.

Avian influenza has kept the attention of the international community, with outbreaks that have affected the economy of thousands of producers as well as international trade in countries where the virus has been detected. The cases reported from 2004 to date are registered on the OIE web page. Virtually all regions of the world have reported cases. Some examples are:

- In Pennsylvania, US, between 1983 and 1984, 17 million birds were slaughtered at an estimated cost of USD 60 million, which translated into a 30% increase in egg price to the consumer.
- In the 1990s infectious outbreaks occurred in Australia (1994 and 1997), Hong Kong (1997 and 2001) and Italy (1999-2000). In all the cases, the implementation of precautionary measures, depopulation of birds and compensation for losses in production were necessary.
- The most serious cases were registered in Cambodia, Indonesia, Laos and Thailand in the period 2003-2005, where it is calculated that 140 million birds died or were slaughtered.
- In the first quarter of 2006, in France, the H5N1 strain caused the loss of about 40% of the income of the producers.

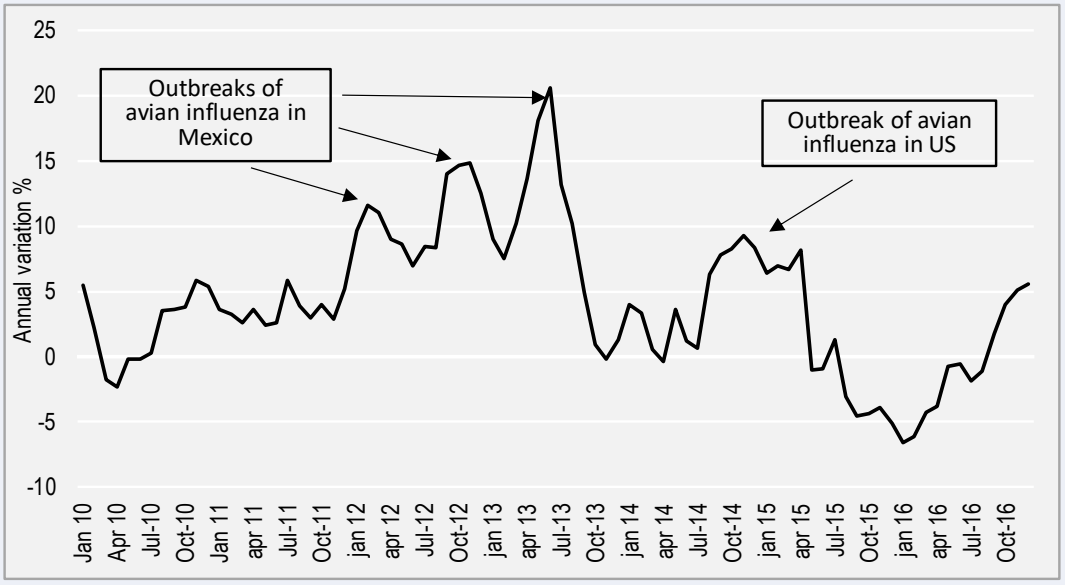
More recently, outbreaks were identified in Australia, Pakistan and Mexico, the latter in 2012.

The Mexican sanitary emergency in 2012 occurred in the western part of the country, in the area known as Los Altos, in the state of Jalisco, and it was caused by the H7N3 HPAI virus (without impact on human health, although it was aggressive for birds), in three commercial laying hen farms. The outbreak was announced by SENASICA to OIE, in June 2012.

To prevent the spread of the virus, the authorities installed eight mobilisation controls in quarantined areas, in co-ordination with the army and the federal police. Additionally, the country produced a vaccine in 39 days and 165.9 million doses were administered

The health contingency affected the growth of chicken production. The growth rate of production decreased from 3.8% in 2011 to 0.93%. This affected prices that increased by 24.4% between December 2011 and June 2013. In May 2013, the Ministry of Economy opened an import quota of chicken meat for 300 000 t, to address the effects of the crisis. The figure shows that outbreaks of influenza seem to be related to the price increase. The price increase seems to be related to the outbreaks of influenza.

Figure 6.2. Variation in the price of chicken meat, annual variation



Source: INEGI

The crisis provoked the slaughter of 22.4 million birds. It was required to implement an Epidemiological Surveillance Programme, which included testing on farms located in 22 states as well as national monitoring. To address the effects, the producers constituted a trust to which they contributed 30 million pesos. The Federal Government contributed MXN 100 million and state governments contributed MXN 70 million. Additionally, development banks channeled financial and technological support. SAGARPA granted guarantees for loans for the repopulation of flocks, restructuring and consolidation of liabilities.

Between January 2014 and November 2016, the disease was identified in 77 countries and 13 strains were detected. In the United States, between the end of 2014 and the middle of 2015, the disease resulted in the death of some 50 million birds.

In the facilities there is a waterhole. To exploit a waterhole, a concession for the extraction of water is required, granted by CONAGUA. Since the water is for agricultural use, it has no cost. However, CONAGUA have argued that water used for the sanitisation of vehicles and people who have access to the farms does not have an agricultural use, although they are related activities that are in fact carried to comply with recommended practices in the industry. This situation generates more administrative procedures, verification and ends up increasing costs unnecessarily.

Farms must be properly fenced and bounded. Access should be avoided by unauthorised persons, as well as by animals outside the facility. There must be control of the access of people, vehicles, materials, food and flocks. Also, vehicles and people should be disinfected.

Farms have a diverse number of chicken houses. In Mexico, as indicated by the interviewees, the number of chicken houses can vary from 1 to 12. The model is of chicken

houses of approximately 2 000 square metres (m^2), which house up to 25 000 chicks. The industry practice is to house between 10.5 and 13.5 chicks per m^2.[48]

The chicken houses protect the birds, because they provide a microclimate conducive to production and provide space, comfort and security. In Mexico there are two types of chicken houses: open and controlled environment.[49]

The former have open walls that allow natural ventilation and can be provided with curtains and air barriers. The latter are closed buildings with automated control of temperature, humidity and ventilation. This type of structure decreases labour costs, although it requires a greater investment than open houses.

Interviewees pointed out that larger companies tend to follow the closed chicken house model, although most producers probably operate with open houses. There is no information available to identify the percentage of producers who follow one model or the other.

For this study, it was possible to visit the facilities of one of the leading producers. The farm which was visited has controlled environmental facilities so that the birds are not affected by the external environment. The houses have a ventilation system that allow to air enter the house, is circulated and extracted from it, using fans. The houses follow an orientation east-west, to always maintain the same position of sunlight.

The internal control of the temperature is of great relevance. Day-old chicks require temperatures around 32 degrees, while more mature animals require temperatures of around 21 degrees.

Controlled environment houses allow better control of health security, especially regarding migratory birds, which are carriers of disease and are a common phenomenon in the North American region.

The houses must have a concrete floor or similar. At the beginning of the process different materials (straw, sawdust, cereal husks, ground cob) are spread, which act as a bed for the birds. During the six or seven weeks of the growth process, the birds produce excretions, which are mixed with the bedding material. These materials (called *pollinaza*) are removed once the growth process is complete and the birds are evacuated for slaughter. The *pollinaza* is a mixture that has a high protein value and is used to feed ruminants and as fertiliser. However, special handling is required because of its content of ammonia; therapeutic chemicals (arsenic, antibiotics); minerals such as copper, calcium, phosphorus, sodium, potassium, magnesium, manganese, iron and zinc (which can contaminate groundwater); and because it carries pathogens.

6.5. Feeding

Feeding is essential for the good development of poultry and can account for up to 65% of the total cost of meat production (UNA, 2016).

[48] The authority recommends the following measures: width of 9.8 to 12.2 metres (m), depending on the climate of the region; a height of 2.4 to 3 m in hot climates; length depending on the production you want to obtain; and a separation of 20 to 30 m between chicken houses. See SAGARPA (2009).

[49] Idem.

Although each company follows a food strategy, there are certain general principles followed by mass-producing companies. The food is provided in the form of pelleted rations of a corn mixture that provides energy (sorghum can also be used), soy paste, which provides protein content, fats and oils and vitamins and supplements. It is also possible that the food contains antibiotics and other additives for health care.

There are different preferences for the colour of the meat, depending on the region of the country. In the centre and the south of the country yellow chicken is preferred, so vegetable supplements are added to the balanced feed to allow the animal to develop that coloration. However, this increases the cost of production. In the north of the country there is preference for the coloration of white skin.

Companies must take care of the proper nutrition of the animals, but they must also consider their energy consumption. The feeders are located in the houses in a way that prevents animals from frequent trips, which involve energy wear. Grain is also important because the grinding and digestion effort can generate calorie consumption.

The first week of life of the animal is fundamental and it is necessary to maximise weight gain, as this affects the future development of the bird. The starter food contains high levels of protein, an expensive ingredient. The growth and finishing food may be low in protein. It is possible that the starter diet includes 24% protein, the growth diet contains 20% and completion only 18%.[50] Each company follows a food strategy. It is possible for companies to manage up to five categories of food.

The basis of the food is corn and sometimes sorghum, soya paste, which is obtained as a by-product in the manufacture of soybean oil, fats and oils, as well as other additives. Yellow corn is the main variety used, however, it is possible to use white corn.

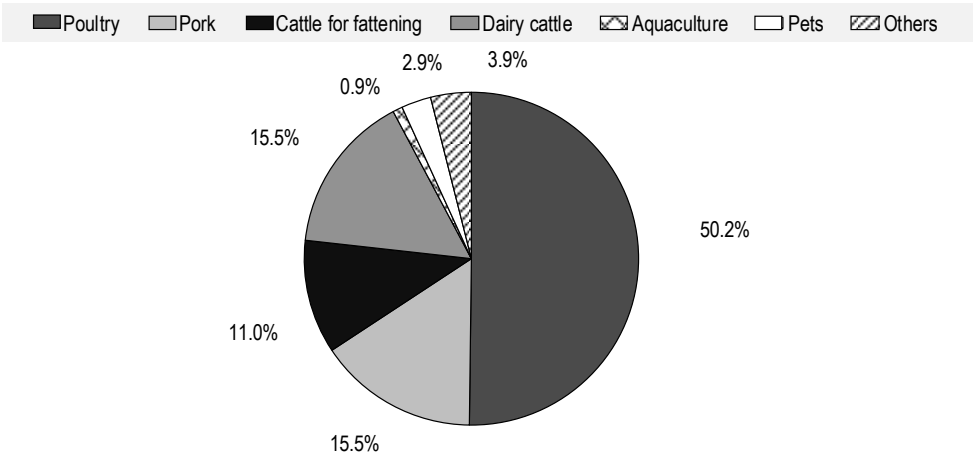
According to some interviewees, protein paste, such as soy paste, can represent between 20-25% of the mixture. The remainder corresponds to fats and oils and cereal by-products. Finally, micronutrients such as vitamins, minerals, amino acids and additives are added. Among the additives are enzymes, pre and probiotics, preservatives, antioxidants, flavouring and growth promoters. Among the latter, growth promoting antibiotics can be found. Approximately two k of food are required to produce one k of meat.

Rail transport is essential for the transportation of corn, in particular the yellow variety, which is mostly imported from the United States. The companies that produce the food can contract the transport of the grain. However, the companies that have the capacity to contract consolidated trains, that is, trains of 110 wagons, capable of transporting up to 11 000 t in a single delivery, have a cost advantage, because the cost of the transfer is cheaper, in particular if the company has the capacity to unload the wagons quickly. An operation with these characteristics requires, in addition to operating on a large scale, a spacious yard and a railway spur. The logistical handling of the grain could be simplified with more national supply of corn near the regions of consumption. This is the objective of India, which, as already mentioned, aims to develop the chicken meat industry in a way that geographically integrates this activity with the production of poultry feed.

[50] http://www.elsitioavicola.com/articles/2491/alimentacian-de-pollos-para-obtener-mejor-salud-y-mayor-rendimiento/

The feed industry produced approximately 32 million t in 2016.[51] Of this, about half was poultry feed, as shown in the following figure:[52]

Figure 6.3. Production of balanced feed in 2016, by type of animal



Note: Estimated production, 32 million t.
Source: Consejo Nacional de Fabricantes de Alimentos Balanceados y de la Nutrición Animal, A.C.

The vertically integrated model is the predominant one. Statistics indicate that 65% of the balanced feed is produced and consumed by large integrated companies, while 35% is consumed by the remaining independent farms.

Table 6.1. Balanced feed for poultry production (thousand t)

		Integrated		Commercial	
	Total	producers	% total	production	% total
2012	8 460	5 499	65.0%	2 961	35.0%
2013	8 374	5 485	65.5%	2 889	34.5%
2014	8 768	5 765	65.8%	3 003	34.2%
2015*	9 174	6 032	65.8%	3 142	34.2%
2016**	9 473	6 148	64.9%	3 325	35.1%

Note: *Preliminary. **Estimate
Source: Consejo Nacional de Fabricantes de Alimentos Balanceados y de la Nutrición Animal, A.C.

In 2016, it is expected that the production of feed would have been 9.5 million t, which implies an approximate consumption of 6 million t of grain, mainly yellow corn. Given that chicken meat consumption is expected to increase by 20% by 2025 (due to an increase in

[51] According to CONAFAB, imports are equivalent to 0.5% of national production. See CONAFAB (2016), La industria alimentaria animal de México 2016.

[52] 59% of poultry feed production is used for meat production and 41% for egg production. See Pedroza, A. (2016), La industria alimentaria animal de México 2016, Consejo Nacional de Fabricantes de Alimentos Balanceados y de la Nutrición Animal, A.C. available at, http://cic.zoga.com.mx/pdf/nutricion-La-Industria-Alimentaria-Animal-de-Mexico-2016.pdf

per capita consumption and population growth), demand for grain will also increase, as national production of meat increases.

6.6. Product

Production farms receive day-old chicks and deliver chicken for processing (poultry), weighing between approximately 2 and 3.2 kg.

The farms are organised in such a way that the whole chick flock that enters a chicken house is the same age. This is for reasons of animal control and also for productivity reasons. The growth of the birds follows a programme of phytosanitary care, temperature control and feeding.

Birds are kept up to seven weeks under growth. Depending on the desired size of the animals, it is the number of weeks that they remain on the farm. Moreover, the whole chick flock of each company comes from the same genetic line; what varies is the breeding period.

After breeding, the chicken is mobilised to the processing plants. Then the farm begins various actions, such as cleaning, collection and disposal of *pollinaza* and disinfection, which can take several days. After this stage, the farm initiates a breeding cycle again.

6.7. Production and participants in the industry

There is no public information on the number of farms in Mexico. The available information is compiled by UNA and refers to the number of companies that operate and their size.

According to the UNA, in 1996 there were 210 companies operating farms. The number has decreased, so that in 2015 there were only 159. By size, the organisation reports the existence of 2 large companies, 22 medium-sized and 135 small-sized. The source does not indicate the criterion to classify the companies' size.

In addition to the fact that the market has consolidated the number of competitors, there is a greater concentration of production. The two largest companies, which accounted for 33% of production in 1996, accounted for 55% in 2015. By contrast, small firms reduced their presence from 27% to 8%.

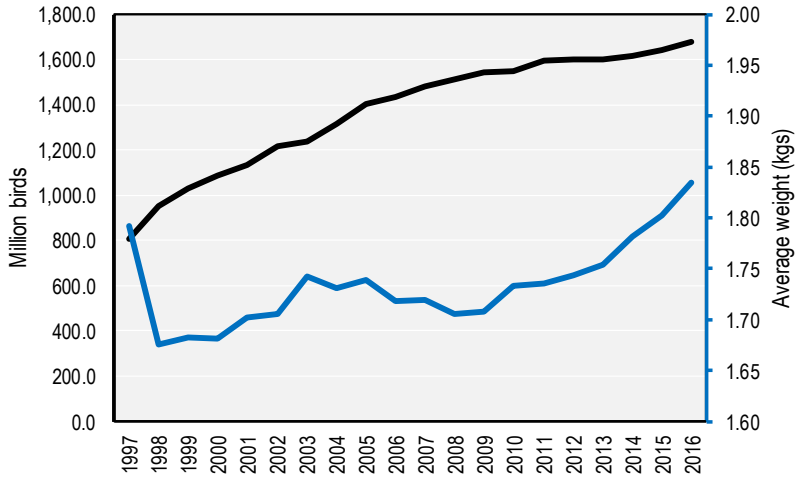
Table 6.2. Stratification of poultry farms

	Number of companies		Share in production	
Classification	**1996**	**2015**	**1996**	**2015**
Big	2	2	33.0%	55.0%
Medium	27	22	40.0%	37.0%
Small	181	135	27.0%	8.0%
Total	210	159		

Source: UNA (2016), Compendio de indicadores económicos del sector avícola.

In 2016, live chicken production was 1 676 million birds, with an average weight of 1.8 kg. Production has expanded at a rate of close to 4% per year.

Figure 6.4. Live chicken production, 1997-2016 (million birds)



Source: http://infosiap.siap.gob.mx/anpecuario_siapx_gobmx/ResumenNacional.do

There is no official source for the companies' market share. The following are calculations that were made considering the information on the total number of live birds produced, provided by the SIAP, as well as information from one of the specialised publications of the industry, which reports its estimates of production per company.

Table 6.3. Live chicken production per company, 2016 (million birds)

Company	Birds	Market share
Industrias Bachoco	595.0	35.5%
Pilgrim´s de México	470.0	28.0%
Grupo Pecuario San Antonio	83.4	5.0%
Avigrupo	78.0	4.7%
Buenaventura	58.4	3.5%
PATSA	52.0	3.1%
Agroindustrias Quesada	45.0	2.7%
Interpec San Marcos	44.0	2.6%
Pollo Industrializado de México	42.0	2.5%
Grupo Avimarca	23.0	1.4%
Otros	186.1	11.1%
Total	1,676.9	

Note: Add the note here. If you do not need a note, please delete this line.
Source: Elaborated with information from SIAP, http://infosiap.siap.gob.mx/anpecuario_siapx_gobmx/ResumenNacional.do and Industria Avícola, March 2017, http://www.industriaavicola-digital.com/201703/index.php

According to this information, Industrias Bachoco and Pilgrims de México represent 65% of poultry production.[53] The 4 largest agents would account for 75%. The Herfindahl-Hirschman Index is 2 147 points.

[53] This data differs from that expressed by UNA, which indicates that the 2 largest groups in farm production represent 55%.

The information does not indicate the proportion of production assigned to each company, which corresponds to the operation of own farms and that from third-party farms, which operate under a contractual scheme.

6.8. Production costs

The following table shows the cost structure of farm poultry production:

Table 6.4. Cost structure of poultry production

Concept	Total %
Feed	66%
Day-old chicks	14%
Workforce	5%
Electricity, water and gas	3%
Drugs	2%
Total direct cost	90%
Marketing expenses	6%
Management expenses	4%
Total indirect cost	10%

Source: UNA (2016), Compendio de indicadores económicos del sector avícola.

Direct costs represent 90% of the total cost. The most relevant costs are food, which is two thirds of the total cost and the chick, which represents 14%.

6.9. Barriers to entry

Some of the interviewees have pointed out that it is difficult to find land with the size, location and characteristics required. The minimum distances to be kept in relation to the population, roads and other agricultural production units mean that only a few parcels of land are candidates for a facility of this nature.

Interviewees point to a lack of co-ordination between different levels of government in land use, which cause uncertainty and affects investment decisions. They also mentioned that land ownership is not flexible and makes it difficult to access real estate for production.

Some interviewees indicated that small and medium producers have access to genetic lines, although there is no information to corroborate this fact. However, supplier companies could have incentives to give preference to their larger customers, when there is a high demand for fertile eggs or chickens,

In terms of investment, chicken houses, storage and transport equipment, among other investments, are required. There is no single model of facilities. The investment will depend on the type of houses (open or controlled environment), their size, number and level of automation, among other aspects.[54] According to one of interviewees, installations costs are between MXN 4 and 5 million per house.

The degree of vertical integration is critical to the success of a farm. The business has low profit margins. The farm must guarantee its access to the inputs. A small or even a medium farm has no access to genetics that allows it to have its own heavy-breeding facilities. It is

[54] See https://avicultura.info/costes-de-produccion-en-granjas-de-broilers/

necessary to operate on a larger scale, to access the suppliers of the genetic lines and guarantee them the economic capacity to install farms of heavy reproduction, with the required biological safety measures.

It will be possible to have one-s own incubators, depending on the operating volume of the producer. Otherwise it depends on the provision of third-party chicks.

For an independent farm or small business, it is difficult to self-supply the necessary food. The vertically integrated model considers the production of food for self-consumption. One interviewee even pointed out that the participation of vertically integrated companies can be as important in the grain market as consumers, allowing them to compete for the contracting of ASERCA price coverage programmes. In this way, companies minimise their exposure to the risk of variations in the cost of inputs for food processing.

Vertical integration solves problems of access to chicken processing facilities. Independent farms market live chicken to certain animal processors or brokers and therefore are more exposed to changing market conditions.

Independent farms that maintain long-term contractual relationships with integrators have access to inputs (chickens, food) and should not worry about accessing the market. Under some contractual models, these farms are the service providers of the integrators.

6.10. Substitution

The consumers of poultry raised on farms are poultry processing companies and live poultry traders. The specialisation of the activities of these demanding agents ensures that the poultry produced by the farms can only be replaced by birds from other farms.

In terms of the final consumer, there is a differential in the prices of different sources of meat protein, (see Section 10. Evolution of Prices), which means that if there were an increase in the price of chicken meat, in a magnitude of 5%-10%, consumers would hardly migrate to beef and pork. On the other hand, the supply of turkey meat is marginal and unable to respond massively to market demand.

In terms of supply-side substitution, the assets used for the production of poultry on farms, with the exception of real estate, have few possibilities of being used for alternative activities, since they are assets specific to poultry production. This gives rise to a commitment problem that, according to some studies, exists in the United States.

In relation to incubators, the equipment is highly specialised and has no alternative uses. Food production facilities could probably be used to produce for the market and not only for self-consumption and to produce food for other species.

6.11. Conclusions

The industrialised segment of the market follows a trend towards automation and mechanisation, from the operation of farms to processing. An increasingly uniform product is also obtained by using genetically selected varieties and by the application of standardised procedures. Although most of the market is served in this way, in Mexico there is a segment of producers that operate independent farms and whose operation is not documented. This could represent at least one-third of chicken breeding activities.

The process begins in the farms of heavy reproduction, where the fertile egg is obtained by the flocks of mother birds. Only the larger producers operate this type of facility, and are

provided with poultry produced by genetics companies. Breeding chickens are obtained from fertile egg, through incubation procedures.

Production farms are the facilities where poultry is produced for later slaughter. Various technical, health and legal requirements must be met for the installation of a farm. Regarding the legal aspect, the interviewees indicated the existence of obstacles to the full enjoyment of property rights, which could affect uncertainty and investment.

It was also pointed out that the regulations governing distances between farms, human settlements and other facilities come from administrative agreements, which supplement the functions of official standards, although they lack the same enforcement and sanctioning capacities.

Interviewees indicated that there is a lack of co-ordination between federal, state and municipal authorities, which encourages local authorities to enforce provisions that are contrary to federal regulations. The regulation of land use is an area in which these differences occur.

The cost of feeding is the main cost of producing poultry. Large integrating companies are owners of facilities for the production of balanced feed, because that way they obtain economies. The existence of obstacles in access to food was not identified. What can be concluded is that non-vertically integrated companies have a cost disadvantage, since they must pay a margin to a third party. About one-third of the birds are known to be fed commercial feed, i.e. vertical integration with food production occurs for two-thirds of the market.

Yellow corn is the main component of the feeding of the birds, although white corn can be also used. The integrating companies mobilise large volumes of grain, which gives them an advantage in transport costs. Yellow corn comes mainly from the United States, as Mexico is not self-sufficient in this product. In this sense, having local sources of grain supply could help reduce logistical costs.

There is no information available to determine how many farms exist, how many operate under contract, how many are independent or how many belong to integrating companies. It is known that there has been an increase in concentration, as according to UNA data there are fewer small companies than in 1996 and the larger ones comprise a larger proportion of the market.

Concerning barriers, the conditions under which small and medium-sized enterprises could access genetic lines are unknown. For reasons of investment and timely and sufficient supply, it is difficult for a medium or small company to invest in processing plants. These facilities require the continuous operation of a "production train" that guarantees the permanent provision of live chicken, which can only be achieved if there is a significant number of farms operating with staggered deliveries. At the various links in the chain, specific investments that could represent significant sunk costs are required. These factors could be indicative of barriers to entry.

Chapter 7. Relationships between participants in the value chain

7.1. Vertical integration and contracting

In Mexico, Bachoco, which has the largest market presence, has followed a model based on vertical integration with production farms and has contracted minimally with third parties.[55] However, according to some of the interviewees, most poultry production takes place in units that supply processors through contractual relationships, with different obligations for the parties, or by marketing live chickens in a spot market. One of the contractual modalities is sharecropping.

There are no statistics to establish the percentage of production coming from vertically integrated farms owned by the processors and also to determine the degree of penetration of the various contracting modalities that may exist. However, unlike the United States, in Mexico the vertical integration model has a significant presence. For example, Bachoco has 693 facilities related to poultry production, of which 126 correspond to breeding farms, 23 are incubators, 518 are poultry farms, 8 are processing plants and 18 are food production plants.[56]

Some interviewees pointed out that the American model is based on the existence of an extensive credit market, which allows farmers to access long-term credit to finance the installation of farms. In Mexico, for decades farmers lacked acceptable conditions of access to credit. In addition, the conditions of exposure to market and phytosanitary risks led processors to try to own farms.[57]

According to the interviewees, in the contractual modality the farmers provide care services for the animals, according to the parameters established by integrators. These provide the animals, the food and the training for the farmers, who receive a payment agreed beforehand. Farmers must meet cost and productivity goals. Apparently, tournament mechanisms are used as in the case of the United States.

[55] The company indicates that 75% of the farms that it operates are its property and the remaining 25% are leased or used through contracts with breeders. See Industrias Bachoco S.A.B. de C.V. (2016), Form 20-F, https://corporativo.bachoco.com.mx/wp-content/uploads/2017/04/Industrias-Bachoco-20-F-2016.pdf

[56] Idem.

[57] According to the interviewees, the precursor of the vertical integration model was Purina, a producer of balanced feed, which for decades decided to integrate vertically with the production of poultry, to strengthen the sale of its food products. Currently the company belongs to Cargill and is unrelated to livestock production.

7.2. Sharecropping

Sharecropping is a modality established in the Federal Civil Code and in the Civil Code for the Federal District, in Chapter VII. There are two types of sharecropping: agricultural and livestock. Its development takes place through the signing of contracts between the two parties involved.

Livestock sharecropping is defined in Article 2752 of the cited codes, which states that this takes place when a person gives a number of animals to another to care for and feed them, in order to share the fruits in an agreed proportion. The objective of livestock sharecropping is the breeding of animals and obtaining products such as hides, manes, wool, milk, etc.

The contractual conditions are established by the parties. In the absence of a contractual instrument, local custom is followed.

The contract states that there are two parties. The first is the owner of the animals; the second is the sharecropper, who agrees to take over the livestock management. Article 2755 provides that the livestock sharecropper is obliged to care for and treat the animals of the counterpart, the care they ordinarily provides to their own. Otherwise, the sharecropper could be liable for damages.

The owner undertakes to guarantee to the sharecropper the possession and use of the cattle and in case of eviction, to substitute the lost animals; otherwise, it is liable for damages and any losses to which it gives rise due to the non-performance of the contract. The law prevents the sharecropper from having any head or offspring without the consent of the owner.

The clauses of the contracts may provide for the following:

- an agreement of the owner, to deliver the animals so that they are taken care of by the sharecropper;
- a commitment by the sharecropper to care for and feed the animals, as if they were his property;
- the commitment of the owner to give a percentage of the profits of the animals (usually 20%), as remuneration for the service provided;
- mutual commitments not to dispose of animals without the consent of the counterpart.

As pointed out by some interviewees, in the case of chicken sharecropping, various modalities are used to solve health risk issues, waste disposal, animal weighing, food supply, veterinary care and training, among other aspects.

The sharecropping contract is usually accompanied by a contract of sale, by which the owner agrees to purchase the percentage of production that corresponds to that of the sharecropper as remuneration.

7.3. Experience of FIRA in the area of La Laguna

FIRA provides loans to financial intermediaries, which offer credits to economic agents involved in agricultural activities. In the case of poultry meat, in 2014 FIRA channeled almost MXN 2.5 billion, of which 82.8% went to primary activities, 11.2% to industrial activities, 4.5% to commercialisation and the rest to various services.[58]

The northern part of the country, and in particular La Laguna, which includes territories of the states of Coahuila and Durango, are important recipients of support for the development of livestock activities, including the production of chicken and beef meats. Both states represent 12% of national production and are one of the most important producing areas along with Jalisco and Veracruz.

La Laguna represents about 90% of the production of the mentioned states. Between the 1980s and 2000, sharecropping took place, accounting for about 50% of the production in the area, including social producers and the development of joint ventures between producers (they invested in a gas station).

Economic circumstances led the producers to a situation close to bankruptcy, particularly the crisis of 1994. The accompaniment of FIRA and the relationship with the main integrator of the area (Tyson), allowed it to create mechanisms for finance production and reduce the market risks faced by producers.

According to FIRA, Pilgrim´s-Tyson[59] maintains a strategic alliance with more than 100 producers of the social sector in the area. Even before the alliance, the area was characterised by unfavourable economic conditions, such as a lack of water that limits agricultural activities, pests and lower prices that affected cotton planting, and a lack of technical advice and access to credit.

Under these conditions, poultry farming has advantages because it requires smaller areas, uses less water and generates more employment than agricultural activities.

[58]FIRA (2015), Panorama agroalimentario avicultura carne 2015, https://www.gob.mx/cms/uploads/attachment/file/61946/Panorama_Agroalimentario_Avicultura_Carne_2015.pdf

[59] The companies merged in 2015.

Box 7.1. Characteristics of the strategic alliance between Pilgrims-Tyson, FIRA and social producers

The initial conditions for the social producers who joined the alliance were:

- to have suitable land and water for the project;
- location within a 50-km radius of Gómez Palacio, Durango;
- to accredit moral solvency;
- farm contribution (10% of the investment).

Producers had to show willingness to care for animals, as well as a commitment to organise and enter into contracts.[1]

The model works as follows:

- There are sharecropping and marketing contracts between the small producers and subsidiaries of Pilgrim´s-Tyson.
- The sharecroppers build chicken houses with FIRA´s support. Initially, the company offered endorsement. The interviewees pointed out that at the present time the company guarantees the acquisition of the product.
- Inputs are purchased by Pilgrim´s-Tyson, and are supplied to farms.
- Producers provide chicken houses and complementary resources (labour, gas, wood chips, electricity).
- At the end of the production cycle, the parties evaluate the results and distribute the production between the company and the social producers, based on the sharecropping contract. The company acquires the part of the production that corresponds to the producers.

Payments are made:

- Per kg delivered.
- For stimulus to productivity, in a scheme similar to the US tournaments. Cost of each flock is compared with the average of the last weeks. The payment per kg adds or subtracts the difference of the individual cost from the average.
- Withholdings are made if there are investment commitments financed by Pilgrim´s-Tyson.

The scheme is beneficial for the parties involved because:

- Social producers have access to credit and technology, as well as protection against financial, market and health risks. Production is obtained at a lower cost.
- Pilgrim´s-Tyson reduces its investments and improves performance.
- FIRA and banks reduce their operational risks.

In 2010, the company delivered 3 million chicks to producers in the area, 78% of which went to sharecroppers. Of these, 75% corresponded to the social sector.[2]

Notes:

1. See FIRA (2006), "Ganadería por contrato en México: Tyson", available at http://www.fira.gob.mx/Nd/Esquema_AVICULTURA_POR_CONTRATO_en_La_Laguna.pdf
2. See Pérez, J. (2010), "Avicultura por contrato: esquema de aparcería en La Laguna", Tyson, presentation, available at http://www.cnog.org.mx/_documentos/4743_Avicultura_por_Contrato.pdf

The strategic alliance shows that it is possible to achieve collaboration schemes between primary producers and integrating companies. In addition, they are social producers, of whom it has been said that they can hardly be involved in modern production schemes that require collaboration.

The participation of FIRA and Pilgrims-Tyson's guarantee of purchase of production are fundamental to limit the risk of contractual opportunism that arises in the US experience, so that this experience can be useful for the design of policies in other producer areas or other economic agents.

7.4. Conclusions

Bachoco is the company with the largest market share. Its model is predominantly vertically integrated with farms. The other important participant, Pilgrim´s-Tyson, leads a strategic alliance with social producers in the La Laguna area.

Unlike the United States, where contractual relationships between integrators and farms are widely documented and the commitment problem has been discussed in depth, in Mexico there is a lack of information to even determine the proportion of farms operating under some kind of contract.

However, the experience of FIRA in the La Laguna area is interesting. Apparently, the scheme with which the strategic alliance between Pilgrim´s-Tyson and the producers of the social sector operates has similar contractual similarities to the schemes used in the United States, including the existence of tournaments. The distinctive feature is that, in the La Laguna experience, FIRA has intervened to establish conditions that guarantee the adequate provision of chickens to the farms, so that the social producers maintain the necessary income flow to fulfil their credits.

This has prevented, presumably, as regards the experience of La Laguna, the ex-post renegotiation of contractual terms, to the detriment of farmers. It is therefore of great importance to carry out an evaluation of the programme in order to use its favourable aspects for the development of other producers in other areas.

Chapter 8. Processing

8.1. Structure and physiology of birds

Slaughtering and bleeding, as well as stress conditions, modify the physiology and internal processes of animals, which affects the quality of the meat obtained. Stress occurs in capture, loading, transport, unloading and immobilisation activities. In addition to causing stress, improper handling can also lead to fractures and bleeding.

The industry uses methods of immobilisation, to lead the birds to unconsciousness. The methods are several and follow two main purposes: to minimise the suffering of the animal and maintain its life, to proceed to natural bleeding. The bleeding removes about half of the blood, which prevents the flesh from getting spots or a dark tone.

The processing must consider the temperature, since it can affect the pH of the meat, its color and quality. Added to this, temperature control is important to prevent the proliferation of microorganisms. In countries such as the United States, where most of the chicken is marketed in pieces, procedures are applied to accelerate *rigor mortis* and to facilitate deboning within a period of 3.5 hours. The interviewees pointed out that in Mexico there is no need to apply these processes because deboned chicken has a small commercial presence.

8.2. Handling of birds

Live birds are moved from farms to processing plants. The process should be of short duration, as the birds can lose weight in the transfer, and suffer from stress. On the farm, the birds are gathered and harvested. In addition, food must be removed in a timely manner to minimise the risk of contamination from the digestive system during processing.

The interviewees pointed out that in Mexico the harvest is manual. In other countries, it can be mechanised. Mechanisation provides better working conditions, reduces labour costs and reduces stress and injury in animals.

Birds are deposited in containers or boxes in the vehicles that transport them to the processing plants. Birds can be moved for five hours, although ideally, they should not be mobilised for more than two hours. The transfer generates stress due to temperature, noise and movement, and can affect the weight. This can lead to the death of the animal or affect the quality of the meat quality, due to the temperature.

8.3. Main activities

The processing in plant is composed of a set of activities, that have a certain sequence and in which the industry has advanced in automation.

Box 8.1. Main activities related to processing

1. Supply of live birds. By means of trucks that transport the birds in cages or boxes, from the farms to the processing plants.
2. Download. This is done manually. The birds are removed from the cages and deposited on a production line.
3. Stunning. This is done with electricity, although other means can be used. The purpose is to leave the animal unconscious for its slaughtering.
4. Bleeding. A cut is made in the neck, which allows removal up to 50% of the blood.
5. Blanching. Immersion of the birds in hot water or with steam, to facilitate plucking.
6. Plucking. Removal of feathers with mechanical equipment, or manually in low-scale operations.
7. Evisceration. Opening of the cavity of the body, for removal of viscera.
8. Inspection. To ensure that birds are free of disease, carried out by authorised personnel.
9. Portioning. The bird is cut into predetermined pieces.
10. Packing. In single portions or whole.
11. Weighing.

8.4. Control

The food industry has developed tools to control the food production process. At the international level, the reference is HACCP, a mechanism with preventive scientific principles to control and reduce dangers associated with the production. This analysis operates as a standard in several countries and is required by some customers.

The tool contains seven principles:

- analysis of biological, chemical and physical hazards, together with processes to address or prevent them and avoid significant hazards;
- identification of critical control points (CCPs) in the process using a decision diagram;
- establishing critical limits for preventive measures associated with each identified CCP;
- establishing CCP monitoring requirements;
- establishing applicable corrective actions when monitoring indicates that there is a deviation from an established critical limit;
- establishing effective recordkeeping procedures documenting the HACCP system;
- establishing procedures for verification.

The NOM-251-SSA1-2009 standard recommends its use. Appendix A of the standard delves into the application of the analysis and sets out some guidelines (Norma Oficial Mexicana NOM-251-SSA1-2009).

8.5. Inspection

There are three types of processing facilities in Mexico: Federal Inspection Type (TIF), private and municipal.

The TIF system operates by means of a set of specifications of safety and quality with a high sanitary standard. The system follows official standards designed in accordance with international best practices, to certify: the construction of the facilities; their care and sanitation; the equipment used; and processes.

Diseases are monitored and detected by means of veterinary inspection, poultry and product are controlled, and health systems are checked. The TIF establishments obtain a certification granted by SENASICA.

The system requires that the facilities have the following areas (SENASICA, 2014):

- rest area;
- disembarkation; parking for trucks and landings; live hanging;
- chicken rail;
- area for inducing drowsiness/numbness;
- slaughtering;
- bleeding;
- scalding and plucking;
- washing;
- gutting, inspection and processing of viscera;
- pre-cooling;
- cooling;
- cooling chamber storage.

The inspection phases include:

- *ante-mortem* inspection (live birds);
- slaughtering (hanging, numbing or stunning, slaughtering and bleeding);
- scalding;
- plucking;
- evisceration;
- *post-mortem* inspection.

The inspection is carried out by the responsible veterinarian authorised by SAGARPA, as well as by the official veterinarian, who is a staff member of the authority.[60]

TIF facilities are required to have: special drainage systems; an installation to dispose of wastes generated by the plant; a fat recovery tank and disposal systems for stomach contents, blood and waste materials.[61]

For plants in general, best practices point out that wastewater should not be discharged into canals, rivers, streams, or any source of water. They should be directed to a public sewage system, after applying a primary treatment or pre-treatment as a minimum.

The wastewater collection facility should be designed so that it is divided into different systems allowing the separation of the waste. Before starting the design of the treatment system, a study must be carried out to characterise the residual water of the farm or organic matter they contain, as well as the soil where it will be discharged. This will depend on the type and size of the treatment units required.[62]

8.6. Processing plants in Mexico

In Mexico, there are 1 112 establishments for the slaughter of animals, of which 108 are TIF, 138 are private and 866 are municipal. In the case of birds, the number of private and

[60] The inspection system is similar to that of the United States, where the following stages are carried out:

before slaughter, detecting signs of illness or abnormal situations;

after slaughter, finding and eliminating potential conditions of diseases that may affect human health;

conditions that require retention for disposition or condemnation are considered, for example poor livers and kidneys, fractures or luxation with hemorrhage;

sanitary inspection of slaughter in order to prevent fecal contamination in the carcass and to condemn or reprocess it in case of contamination;

cooling, to verify that it takes place in the minimum times established by the authorities to avoid the proliferation of pathogens;

general sanitation of the plant, in order to inspect that the plant is in clean conditions before and during the processing of the birds;

re-inspection of the ready-to-cook carcass after cooling to verify that the birds have been properly processed and are free of viscera and feathers;

residue monitoring, to analyse the possible presence of drugs and chemicals that could affect the human consumption of meat.

See USDA (1987), Meat and Poultry Inspection Manual, Food Safety Inspection Service, and v (2014), Modernization of Poultry Slaughter Inspection: Final Rule, http://www.fsis.usda.gov/wps/wcm/connect/fb8c866a-a9b7-4b0d-81c9-f190c4a8d4d/2011-0012F.htm?MOD=AJPERES

[61] Modificación a la Norma Oficial Mexicana NOM-008-ZOO-1994, Especificaciones zoosanitarias para la construcción y equipamiento de establecimientos para el sacrificio de animales y los dedicados a la industrialización de productos cárnicos, en aquellos puntos que resultaron procedentes, DOF, February 10, 1999, available at http://sagarpa.gob.mx/normateca/normateca2/SENASICA%20NORM%2019.pdf

[62] SAGARPA (2009).

municipal establishments is unknown. It is only known that in 2015 there were 34 TIF establishments dedicated to the slaughter of birds, all private according to the interviewees, which are distributed at the state level as follows:

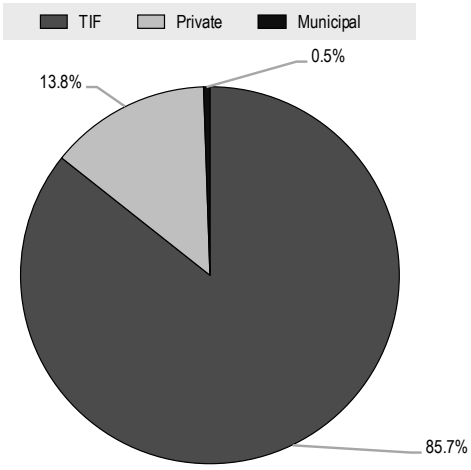
Table 8.1. TIF processing plants for chickens by state, 2015

State	TIF processing plants
Aguascalientes	A-18, 592
Campeche	646
Ciudad de Mexico	468
Chiapas	A-220, 425
Chihuahua	A-213
Comarca Lagunera	A-14, A-88
Guanajuato	A-363
Hidalgo	A-239
Jalisco	A-165, A-183, 552
Nayarit	395
Nuevo León	A-423, 114, 409, 496, 536, 571
Puebla	A-326, 64, 489
Querétaro	A-282, 393
San Luis Potosí	A-206
Sinaloa	A-124
Sonora	635
Veracruz	A-465
Yucatán	A-234, 419, 97 B, 606

Source: UNA (2016), Compendio de indicadores económicos del sector avícola.

SIAP reports that there is a monthly processing capacity on all plants of 76.7 million birds, which represents 920.7 million per year. The distribution of this capacity is as follows:

Figure 8.1. Chicken slaughtering capacity



Source: SIAP (2016), Capacidad instalada para sacrificio de especies pecuarias.

TIF facilities represent 88% of the slaughter, the private ones 11.7% and the rest is served by municipal ones. TIF plants use the largest percentage of installed capacity, with 86%, private 71%; municipal utilities use only half the capacity they own.[63]

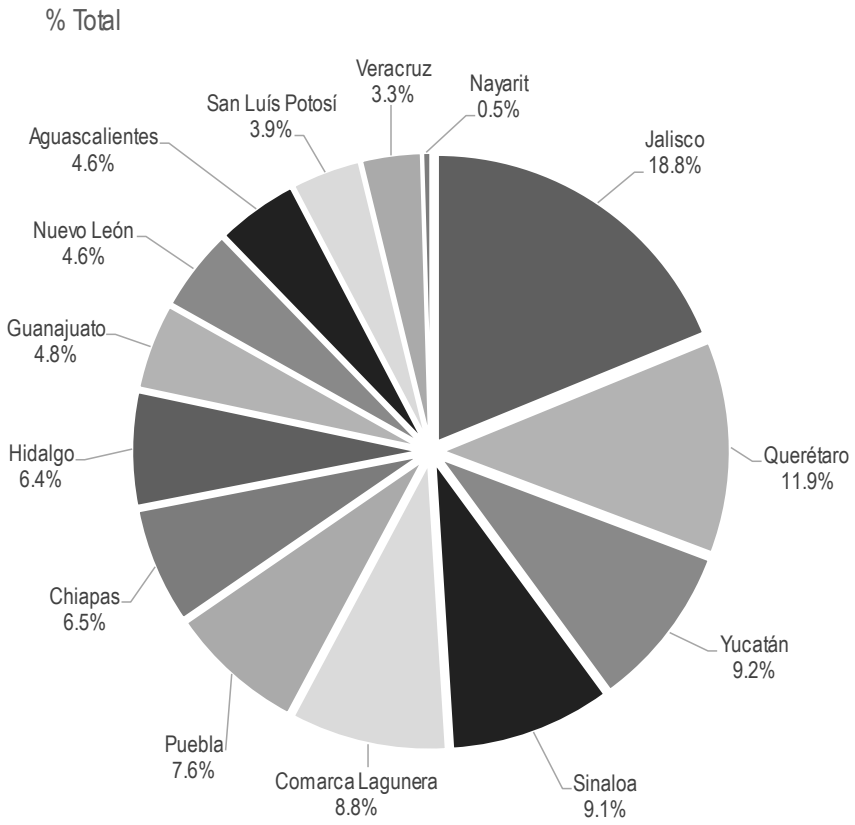
Table 8.2. Installed and used processing capacity by type of processing plant in 2015 (millions of birds)

Type of plant	Installed capacity	Capacity used (%)	Capacity used	% total
TIF	788.9	86.0%	678.5	88.0%
Private	126.8	71.0%	90.0	11.7%
Municipal	4.9	52.0%	2.6	0.3%
Total	920.7		771.1	

Source: SIAP (2016), Capacidad instalada para sacrificio de especies pecuarias.

By federative entity, the slaughter in TIF plants is distributed as follows:

Figure 8.2. Chicken slaughter in TIF processing plants by state in 2015



Source: UNA (2016), Compendio de indicadores económicos del sector avícola.

[63] There are two sources that report figures on the number of animals slaughtered. On the one hand, UNA indicates that 839.8 million birds, including hens, were killed in TIF facilities in 2015. However, SIAP reports 678.5 million. See UNA (2016) and SIAP (2016)

8.7. Production and participants in the industry

The available information allows us to make some calculations about the proportion of the production processed in some type of establishment, with respect to the total production. The number of birds processed in plants varies between 771 million birds, which is the data reported by SIAP for 2015 and an amount close to 930 million birds, a figure that results from adding almost 840 million birds that UNA points out were slaughtered at TIF plants, plus 92 million that SIAP attributes to private plants other than TIF and municipal facilities.

Considering that in 2015 the production was 1 643 million birds, then slaughter in any of the registered facilities (TIF, private, municipal) represents between 47% and 57% of the total production. That is, between 43% and 53% of the production is processed in other places, on which there is no information about their number and location. These could be unregulated establishments, backyard slaughter or domestic slaughter.

Based on the information presented in Section 6.7 above, which presents estimates of market share in the production of live chickens, it is not possible to calculate the market share that economic agents would have in the processing of chickens in the plant. According to the interviewees, larger companies slaughter poultry in TIF-type plants. However, they also market live birds and the way in which they are processed is unknown. A portion of them could be processed by third parties, in some plant of the registered companies. But it is also possible another portion is processed in unregulated facilities.

8.8. Barriers to entry

Several interviewees indicated that the processing activity has been concentrated, particularly in TIF facilities. They also point out that for chicken farmers, it is difficult to enter into the field of processing activities, due to the scale required.

The chicken house model for production in-farm considers the production of 25 000 chickens for each one of the houses. Processing the chickens from a house requires a slaughtering capacity of approximately 1 500 chickens per hour, assuming 2 shifts per day. On this scale, the processing plant requires the daily supply of one chicken house, that is, 365 houses a year.[64]

Processing is an industrialised activity, based on the operation of a continuous band that begins with the entrance of the birds coming from the farm and ends with the exit of fresh, refrigerated and frozen product. This requires a "production train", which is a continuous feed of the process, for reasons of operational efficiency. But it also requires synchronisation upstream and downstream, that is, in the provision of day-old chicks, the production of poultry on farms, as well as in marketing.[65]

[64] The industry has both automated and semi-automated equipment, to process from 500 and up to 10 000 birds per hour.

[65] Some estimates from the industry indicate that for low-scale operations, that is 50 to 100 birds slaughtered per day, an investment of less than USD 15 000 is required. In this way, it is not necessary to slaughter daily, the products are freshly sold, the marketing is done directly and the processing is done manually.

A facility that can process up to 5 000 birds per day would cost about USD 500 000, operate about 50 days per year and require a commitment with farms to ensure supply.

In addition to the amount of investment and supply of live chickens, processing faces other obstacles. Retailers require significant product volumes and demand competitive pricing, which puts small processors at a disadvantage. Also, in modern channels there may be commercial practices that limit the entry of medium processors.[66] For example, category management, category captainship, and slotting fees may exist.[67]

8.9. Substitution

The direct clients of processed chicken are distributors and commercial chains, located in traditional and modern channels. The activity of processors in the plant is subject to competitive pressures from other unidentified processors, operating unregulated facilities, and from domestic slaughter.

Downstream, there are limited mechanisms to differentiate the quality or origin of the product, which in many cases considers the chicken as an undifferentiated product for the final consumer.

From the supply point of view, the assets used in the processing are activity-specific. Thus, slaughtering facilities of other species have limited possibilities for being used for the slaughter of chickens. Also, the equipment used in the chicken processing plants can hardly be used in other industrial processes.

8.10. Conclusions

The industrialised processing of birds is a complex activity. First, it requires transfer and handling from the farms to the processing facilities. Then, several actions are carried out in the plant, some of them automated or semi-automated, stunning, bleeding, scalding, plucking, evisceration, inspection, porting, packing and weighing, among others.

The industry applies control mechanisms, including the HACCP tool, which is recommended in the NOM-251-SSA1-2009 official standard.

Processing plants must comply with regulations for their installation and operation, which emphasise aspects related to construction, sanitation, equipment and processes. Notably, TIF plants require inspection by official veterinarians or veterinarians authorised by SAGARPA.

In the case of chicken meat, there are 34 TIF slaughtering facilities. The total of establishments of another nature, private or municipal, is not known. TIF facilities represent 88% of plant processing.

A fully automated facility, which will allow for the slaughter of 250 000 birds per day, 365 days a year, and is required to be part of an integrated system of operation, including growth, processing and distribution, would cost about USD 25 million. See https://attra.ncat.org/attra-pub/viewhtml.php?id=235

On the other hand, an investment was recently announced to increase the capacity of a processing plant in the United Kingdom, from 1.8 to 2.4 million birds per week. The investment amount is GDP 45 million. See http://lincolnshirereporter.co.uk/2016/08/world-leading-45m-scunthorpe-poultry-plant-investment-secures-1600-jobs/

[66] Some interviewees confirmed the existence of this type of commercial practice in Mexico.

[67] For more information see Taylor and Domina (2010).

Slaughter in some types of plants represents between 47% and 57% of total slaughter. Therefore, the slaughter carried out outside plants would be between 43% and 53% of the total. Regarding this segment, there is a lack of information about participants, practices and their location.

Processing is identified as an activity in which there are significant barriers to entry. Large-scale processing requires a continuous supply of birds, so the processor must have supply relationships with the farms. For a farmer, it is difficult to face the cost of investing in a processing plant as well as ensuring the provision of poultry for the plant.

According to some interviewees, processors may face limitations to access the modern channel, due to the existence of practices such as category management, category captaincy and quota allocation.

Chapter 9. Distribution and marketing

9.1. Types of products

Primary processing provides the whole chicken for commercialisation. This processing includes slaughtering, scalding, plucking, evisceration, offal processing, processing of legs and necks and cooling. The latter is mainly made in containers in which the chicken is deposited in layers of ice, for immediate shipment to distribution centres, to be marketed the next day and consumed within the next three days.[68]

There is a secondary processing, which results from cutting the carcasses. There are several types of cuts that are performed, among them: medium; quarter back or front; breast, whole or split, without bone; leg; thigh; wing and breast fillet.

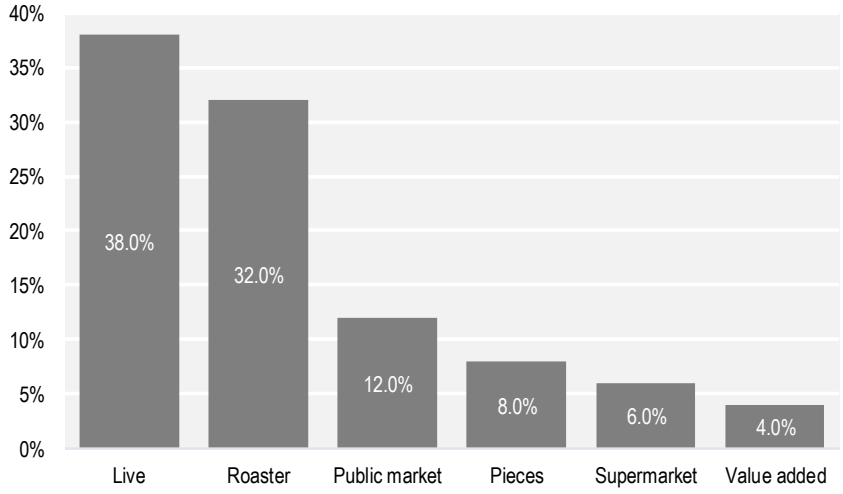
Also, there are value-added products which require special cutting, preparation or packaging. Its process includes the stages already mentioned in primary processing, besides cutting, boning, stocking and slicing, recovery of meat waste, marinating, breading, inlays, weighing, packing, refrigeration and freezing. These products can be kept in refrigerated conditions in the plant or be distributed immediately, in special vehicles that have climate control. Their main destination is the modern distribution channel, through which consumers acquire the products in packages that identify the brand of the company or the commercial chain. Its consumption, unlike the whole chicken, is not necessarily immediate.

The product is classified commercially as follows:[69]

[68] The giblets are edible by humans, as are the heart, gizzards and liver. The remains can be processed for food production for other species or should be disposed of. Other parts of the bird, such as legs, tail and neck, which are not strictly small, may be marketed for human consumption.

[69] This classification is not related to the distribution channel. For example, the category "public market" refers to a type of chicken, not the place where it is sold.

Figure 9.1. Commercial classification of chicken in 2015



Source: UNA (2016), Compendio de indicadores económicos del sector avícola.

The most important category is live chicken sales, which account for 38% of consumption.[70] These are lots of birds purchased by traders, which are transported to the point of sale, where there are corrals with drinkers and feeders. The chicken is slaughtered at the time of its sale or is acquired alive by housewives, who slaughter it. The interviewees indicated a high preference in Mexico for the consumption of freshly slaughtered chicken, also called "hot chicken". Apparently, the phenomenon is not only related to cultural aspects, but has to do with the lack of means of refrigeration and conservation of the product.[71]

The so-called "*rosticero*" chicken, which is not sold exclusively for roasters, is still important.[72] This product accounts for 32% of consumption. These are birds that follow a growth cycle of 35 days, with an average weight between 1.8 kg. and 2.2kg. It is processed

[70] Castañeda, M. and others (2013a), Calidad microbiológica de la carne de pollo, Instituto Nacional de Investigaciones Forestales, available at Agrícolas y Pecuarias, http://www.anetif.org/files/pages/0000000034/19-calidad-microbiologica-de-la-carne-de-pollo.pdf

[71] The handling and transfer of the live bird generates stress, which in some cases can produce the problem of pale, soft and exudative meat (PSE), which is pale in colour, tending to grayish. This meat has a smooth consistency before being cooked. Although it has the same nutritive value as normal meat, its protein structure was modified, which prevents it from retaining water, so that it is not suitable for the production of value-added products. After it is prepared, it is dry, hard and tasteless. This problem could be common because of the high preference in the acquisition of live chickens. However, there is no quantification of the incidence. See Castañeda, M. and others (2013b), Carne de pollo mexicana, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, available at http://www.anetif.org/files/pages/0000000034/15-carne-de-pollo-mexicana.pdf

[72] The roaster chicken is a whole chicken, gutted and ready to be cooked. See Industrias Bachoco S.A.B. de C.V. (2016).

in TIF, private or municipal facilities. Depending on the region of sale, it can be painted by adding pigment in the feed or by applying compounds during processing.

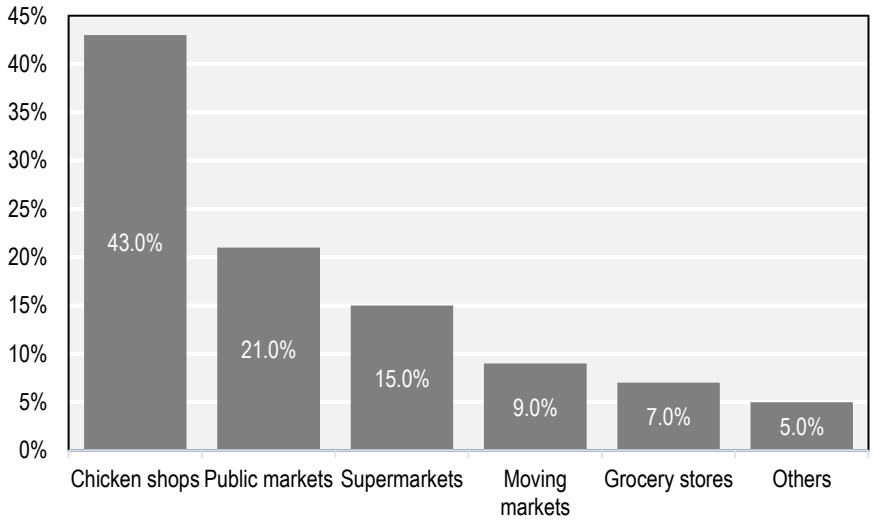
The so-called public market chicken represents 12% of consumption. These are birds with a growth process of 49 days, weigh between 2.8 kg. and 3 kg., and, like the roaster chicken are processed in plants and can be pigmented. The public market chicken is marketed in public markets, outlets, supermarkets and mobile markets.[73]

The supermarket chicken is marketed in the same sales channel, is a chicken of 49 days, weighing between 2.8 kg. and 3 kg., is processed in TIF facilities, and can be pigmented. It represents 6% of sales.[74]

Chicken sold in pieces is equivalent to 8% of the market;[75]these value-added products[76] represent 4% of sales.

The following figure shows the distribution of sales, according to the sales channel:

Figure 9.2. Chicken marketing channels in 2015



Source: INEGI, Encuesta Nacional de Ingresos y Gastos de los Hogares 2014.

9.2. Preservation of cold chain

Section 8.7. above noted that there are various calculations concerning the way the chicken is processed. The information indicates that of the more than 1 600 million birds produced annually, between 43% and 53% are processed in facilities other than those that are

[73] According to Bachoco, it is a whole chicken, eviscerated or non-eviscerated, usually sold up to 48 hours after slaughter. The product is sold to consumers without packaging and without brand identification. Idem.

[74] This product is sold whole with viscera packed separately. Idem.

[75] The chicken in pieces can be marketed in bulk or packaged, to supermarket chains, to the fast food industry or to institutional suppliers. Idem.

[76] These are cuts subjected to treatments such as marinating or breading, or frozen for individual consumption. Idem.

registered (TIF, private, municipal). According to several interviewees, these are unregulated establishments, the so-called backyard slaughter and the slaughter that families carry out at home.

The processed chickens in private facilities represents more than 99% of those registered. This product is channeled to distribution centres of the processing companies themselves or to third parties, or to large consumers, for example, commercial chains or restaurant chains.

Products processed in private processing plants are preserved by cold chains. In the case of whole chicken, it is transferred in vehicles to the distribution centres in ice containers with ice, to ensure that the product maintains conditions that allow its commercialisation and consumption. On the other hand, value-added products and sliced products are transported in vehicles that preserve refrigeration or provide freezing.

The product that is not processed in registered plants, can be sold alive or slaughtered in facilities for which no information is available. The interviewees believe that it is marketed in public markets, "markets on wheels", poultry and other establishments, especially in medium and small towns.

Several interviewees indicated the importance of preserving the cold chain. The interviewees point out that the whole chicken from registered establishments goes to distribution centres; after that it is difficult to guarantee the preservation of the cold chain and the conditions of hygiene.

As for refrigerated or frozen products, the preservation of the cold chain depends on the practices followed by those who handle the product.[77]

9.3. Participants in the industry

Vertically integrated companies direct the processed product to their own and sometimes third-party distribution centres, although some large customers may receive the product directly. From the distribution centres, the company caters to large customers and marketers. INEGI reports the existence of 632 units dedicated to the wholesale marketing of chicken.[78]

Marketers supply retailers from their own facilities. Small retailers, go to the marketing centres with their own vehicles, to transport the product to the final point of sale.

According to some interviewees, about 70% of the chickens from the integrating companies are processed by them. The rest are marketed as live chickens, which reach end consumers through slaughter and distribution mechanisms that are not documented.

[77] A sample analysis indicates that while leaving a TIF plant the product had a measurement of 3.88 in aerobic mesophiles, the product sold at the point of sale reached up to 5.02 aerobic mesophiles in the supermarket, 6.19 in market on wheels and 5.99 in public markets in the centre of the country. See Castañeda and others (2013a).

[78] INEGI, Directorio Estadístico Nacional de Unidades Económicas, http://www.beta.inegi.org.mx/app/mapa/denue/default.aspx

In general, integrating companies do not participate in marketing to the final consumer. This is done by a large number of economic units, which participate in different formats in the modern and traditional channels.

To give a dimension of how fragmented the final marketing can be, we have the following figures:

- – 46 602 retail chicken outlets;
- – 6 037 supermarkets;
- – 628 947 grocery and miscellaneous stores.[79]

There is no information on the number of public markets and street markets. As a reference, in 2015 there were 276 traditional public markets in Mexico City.[80]

9.4. Barriers to entry

The operation of distribution centres may require significant investments, however it is expected that they would be lower than those of the processing plants, because in the distribution centres no modifications are made to the product. In addition to the facilities, a fleet of vehicles may be required for product delivery.

Marketers require vehicles and facilities. However, according to interviewees, as they descend downstream in the chain, the investment requirements are lower.

9.5. Substitution

From a demand point of view, chicken distributors and traders specialise in this type of meat. However, some of them operate facilities from which they distribute other meats, for example beef, pork, turkey and value-added products. Therefore, it is not ruled out that meat distribution centres can modify their configuration to carry out the distribution of chicken.

Commercialisation can be done in unsophisticated installations. For example, poultry shops are often small and local, and even lack refrigeration equipment, because consumers expect them to buy fresh products. The practice is that processed chicken is shipped from processing plants to distribution centres in ice containers (known as “totes”, which contain on average 350 kg of whole chicken), which are used for transportation and preservation at retail outlets. Although from a demand point of view there are no substitutes for a retail establishment specialised in the marketing of chicken, it is easy to reconfigure the establishments.

9.6. Conclusions

According to the commercial classification of the product, most of the consumption is represented by live chicken (38%) and roaster chicken (32%).

[79] Idem.

[80] Laboratorio para la Ciudad, http://datos.labcd.mx/dataset/listado-de-mercados-publicos/resource/ed756eb1-f3a5-4972-ab50-15590ede149f

In terms of marketing channels, poultry shops serve 43% of the market, public markets 21% and supermarkets 15%.

It should be noted that there may be inconsistencies between these figures, as well as those mentioned in the previous section on processing in plants, because the information sources are different: UNA, INEGI and SIAP. The lack of a centralised information system makes it difficult to know precisely the structure of the markets.

Available information indicates that there are 632 chicken wholesale marketers; more than 46 000 chicken outlets; more than 6 000 supermarket stores and more than 600 000 grocery stores and others, of which an undetermined proportion is involved in retail chicken marketing.

The study did not identify any significant restrictions on retail chicken marketing.

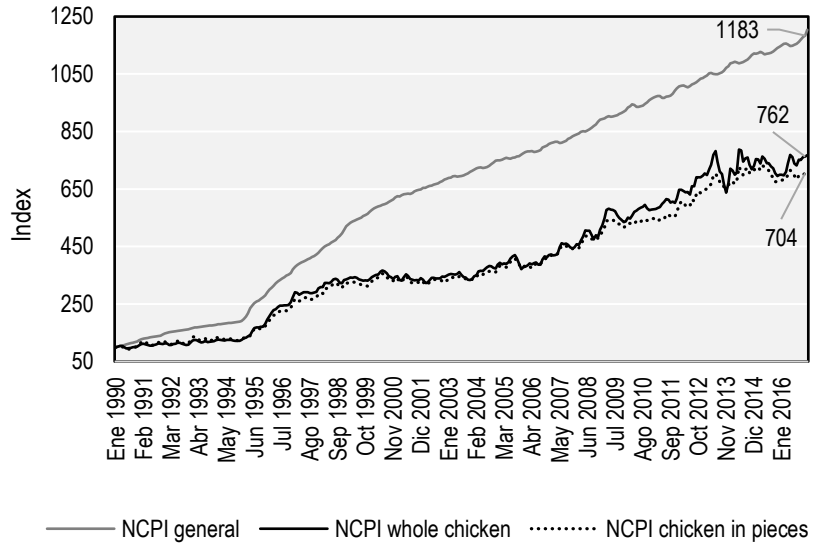
Chapter 10. Evolution of prices

10.1. Consumer prices

In the international context, food prices have generally increased. The same has happened in Mexico. However, chicken meat has had a particular evolution. In Section 2.7 we described the evolution of meat prices, showing how since 1990 the beef price has increased at the same pace as the average price of meat in general; around 80%, while chicken meat has increased by 45% and pork meat by 30%.

Figure 10.1 reports the performance of consumer price indices in general and of whole chicken and chicken pieces.

Figure 10.1. Evolution of the National Consumer Price Index (NCPI) in general and for chicken, 1990-2016 (January 1990=100)



Source: INEGI.

Chicken prices have risen well below consumer prices in general. Taking as a reference January 1990, prices in general have increased by 1 083%, prices of whole chicken increased by 662% and chicken in pieces by 604%.

These data are important, but insufficient to determine the pricing mechanisms that take place in the industry. In the rest of the chapter, we report the results of 3 statistical exercises whose purpose is to investigate market dynamics:

- an exercise to examine the behaviour of relative prices between some of the links that make up the chicken meat value chain: food, wholesale chicken marketing and

final product marketing. To do this, we examine the relationship between input prices for food (maize, sorghum, soybean paste); balanced meal; wholesale prices and retail chicken meat prices.

- an analysis of the evolution of relative prices, of beef, pork and chicken, standing and in channel.
- an analysis of the difference between the average prices of chicken meat, by locality.

10.2. Analysis of relative prices, between links in the chain

In order to study the relationships between links in the chain, exercises were carried out to verify relative price stationarity.

Price series were obtained for products located in different links of the chain:

- inputs for feed: yellow corn, sorghum and soybean paste;[81]
- balanced feed for raising chicken for meat production;[82]
- wholesale price of whole chicken in Mexico City;[83]
- consumer prices in 49 cities.[84]

In the first place, the possible stationary price between poultry feed inputs (yellow corn, sorghum and soybean paste) and balanced feed was analysed. This analysis was performed considering average national prices, since it was not possible to build series at the state level.

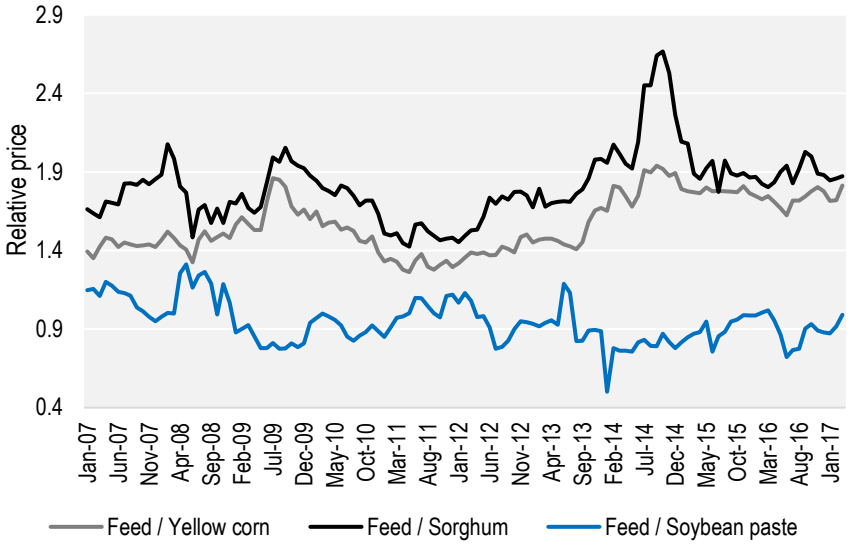
[81] The data are provided by SNIIM and consist of prices of ingredients for the formulation of rations for animal feed per city. The prices of yellow corn, sorghum and soybean paste were considered, since these ingredients are the most frequent in the elaboration of balanced feed for poultry. It was decided to calculate a national average price, since it is difficult to have complete series per city. See http://www.economia-sniim.gob.mx/SNIIM-Pecuarios-Nacionales/e_SelIng.asp?

[82] The SNIIM reports data of balanced feed of two varieties, initiator and finaliser, for poultry production. The information is presented by federative entity, for three formats: tonne in bulk, tonne per bag and per bag. The series are irregular because the same entities are not reported every month. It was decided to build series of average prices for some entities in which it was possible to have extensive series, as in the case of Yucatán, Jalisco, Nuevo León and Estado de Mexico. See http://www.economia-sniim.gob.mx/SNIIM-Pecuarios-Nacionales/e_SelAli.asp?

[83] The SNIIM provides chicken meat price information at the distribution centre, i.e. the wholesale price. It was decided to construct a series of average prices per kg of whole chicken meat, in Mexico City, with information corresponding to the second week of each month, except for the years in which Easter takes place during the second week of April, in which case the first week was taken. See http://www.economia-sniim.gob.mx/SNIIM-Pecuarios-Nacionales/SelSem.asp

[84] INEGI provides average prices with which the National Consumer Price Index is built, for 49 cities. The data do not distinguish by channel, although they do by type of product and sometimes they identify the supplier. Series since January 2011 were constructed on average prices of whole chicken per entity, as well as on a national average. It was detected that there were data that did not correspond to the price per kg but to the price of the whole chicken; for this reason the information was filtered to exclude those prices per kg that were above MNX 50.

Figure 10.2. Evolution of relative prices of feed and inputs for feed production



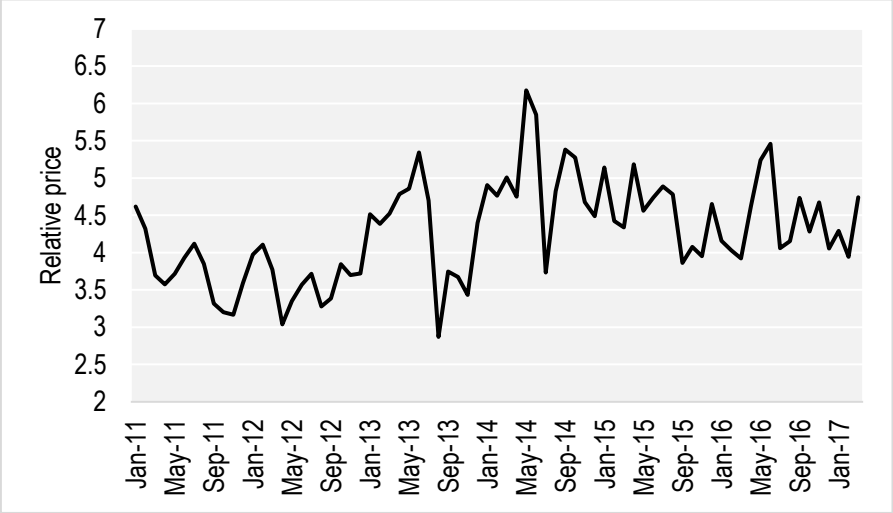
Source: Sistema Nacional de Información e Integración de Mercados (SNIIM).

The results of the tests indicate that feed/yellow corn and feed/ sorghum series, are not stationary and feed/soybean paste series is. This indicates that the trend of the price of the balanced feed differs, statistically, from that followed by the prices of yellow corn and sorghum.

Subsequently, we analysed the stationarity of the series of relative prices, between balanced feed and wholesale chicken. For this, the national average price of the balanced feed and the average price of the whole chicken in Mexico City, expended in distribution centres were used.[85] The data are shown in Figure 10.3:

[85] The evolution of prices of whole chicken were reviewed in relation to those of pieces such as breast, leg and thigh. Similar trajectories were found, since the relative prices between them are stationary. Thus, it is considered that the results of the exercises should not be different if instead of the price of the whole chicken, the price of pieces is used.

Figure 10.3. Relative price of wholesale whole chicken in Mexico City/balanced feed

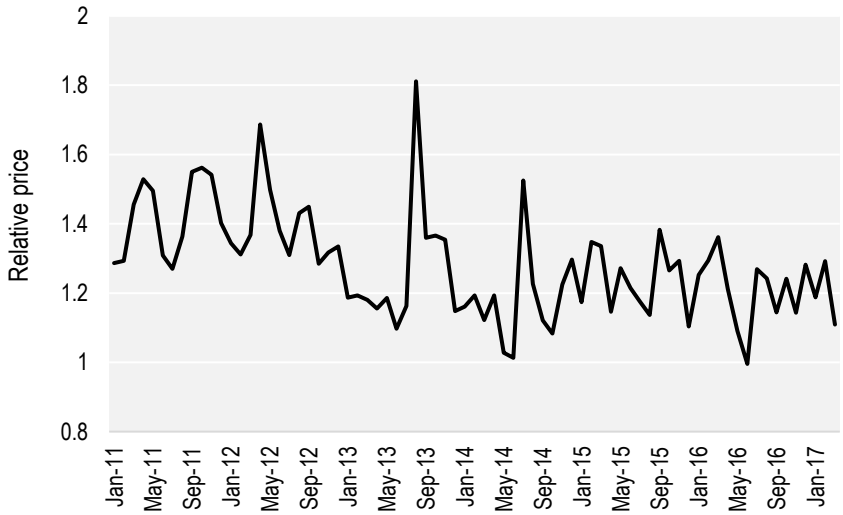


Source: SNIIM and INEGI.

The result of the tests is that the relative price was steady, that is, the prices of food and chicken in the wholesale distribution channel follow similar behaviour.

Finally, the relative price of whole chicken to the final consumer and whole chicken in distribution centres, both in Mexico City, were analysed.

Figure 10.4. Relative price of whole chicken to final consumer/wholesale whole chicken in Mexico City



Source: SNIIM and INEGI.

The results of the tests indicate that the series was stationary.

In conclusion, we analysed the price relationships between links, which produced the following results:

- there is no stationarity of relative prices between balanced feed and feed inputs (yellow corn and sorghum), although stationarity was verified regarding soybean paste;
- there is relative price stationarity between whole chicken in distribution centres and balanced feed;
- there is relative price stationarity between whole chicken for sale to final consumer and whole chicken in distribution centres.

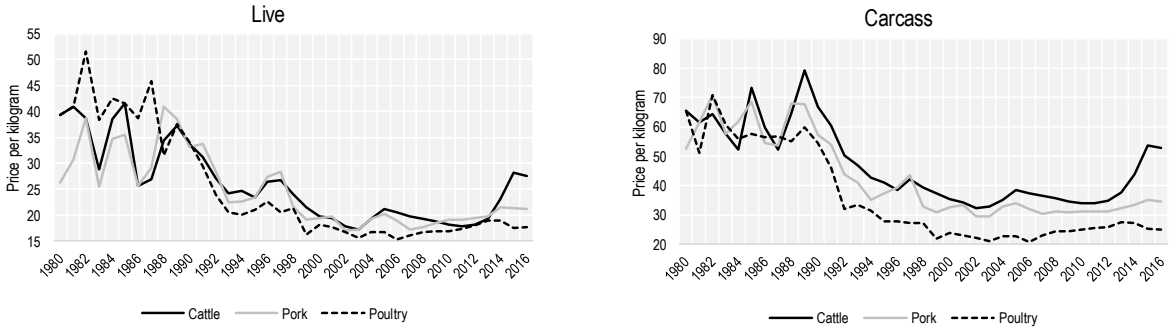
There is statistical asymmetry between the price of balanced feed and grains. In the other products, there does not seem to be any asymmetry between links involved in the pricing mechanism. Although the exercise cannot be considered conclusive, because a comprehensive analysis of the price formation mechanism requires more information, there is evidence that grain producers have lost importance in the distribution of added value of the industry. They have lagged in relation to balanced feed and chicken meat products. No changes are perceived in the relative price of wholesale channels and retailers of chicken marketing.

10.3. Analysis of relative prices of beef, pork and chicken meat

Information was collected on live and carcass prices of beef, pork and chicken meat from 1980 to 2016.[86] The data allowed the analysis of relative prices, although it should be noted that there were fewer observations than the rest of the exercises.

The following figure shows the evolution of the real price of beef, pork and chicken meat between 1980 and 2016. As can be seen, prices have fallen significantly.[87]

Figure 10.5. Evolution of live and carcass prices, 1980-2016 MNX/kg, Dec 2010=100



Source: SIAP.

Table 10.1 shows the average prices of the products, for different periods. For example, in the case of bovine carcass meat, the average price decreased from MNX 63 to MNX 41.5.

[86] SIAP, Producción anual ganadera, http://infosiap.siap.gob.mx/anpecuario_siapx_gobmx/ResumenNacional.do

[87] For the calculation, the average annual price data provided by SIAP were used, which were deflated using the annual average of the National Consumer Price Index provided by INEGI.

For pork, the decrease was from MNX 61.6 to MNX 32.7. For chicken meat, the decrease was from MNX 59 to MNX 25.8 pesos. That is, decreases of 34, 47 and 56%, respectively.

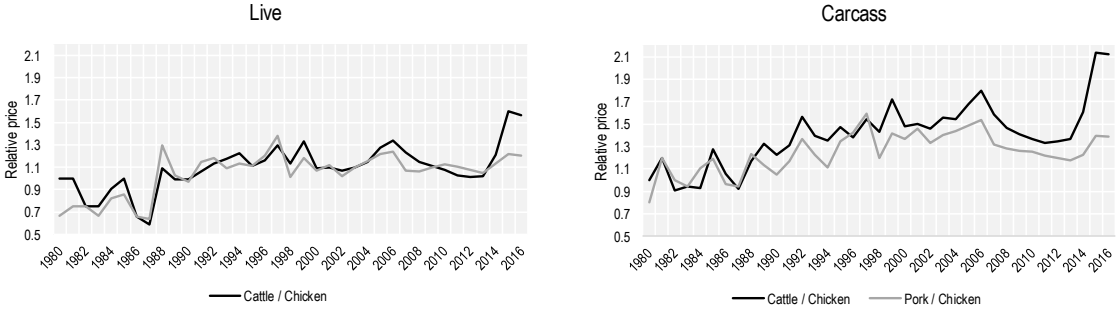
Table 10.1. Average real price of meats per period, MNX/kg, Dec 2010=100

	Cattle		Pork		Poultry	
Period	Live	Carcass	Live	Carcass	Live	Carcass
1980-1989	35.2	63.0	32.6	61.6	40.8	59.0
1990-1999	26.3	46.5	26.0	41.5	23.0	32.9
2000-2009	19.3	35.2	18.5	31.6	16.6	22.8
2010-2016	21.8	41.5	20.2	32.7	17.9	25.8

Source: SIAP.

The statistical exercise consisted in analysing the possible stationarity of relative prices, of beef and pork with respect to chicken, both live and in carcass. Figure 10.6 shows the behaviour of the series:

Figure 10.6. Relative price of beef and pork meats in comparison to chicken meat, 1980-2016



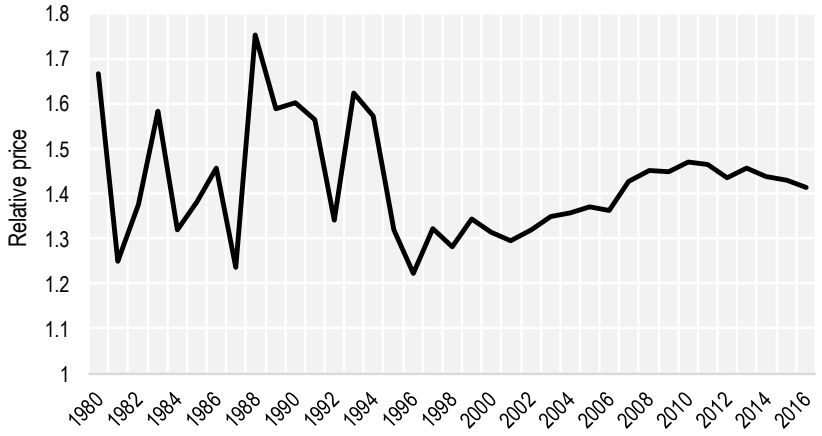
Source: SIAP.

In the case of the relative price of beef/chicken, the tests indicate that the series is not stationary, for live or carcass product. FFigure 10.6. shows that the series have an increasing trend, which means that, although all the meats have seen to reduce in price, beef meat has become more expensive with respect to chicken meat.

Regarding the pork/chicken comparison, the tests performed at 5% indicate that the relative prices of live and carcass products are stationary. However, if the tests are applied at 1%, the result changes. As in the case of the relative price beef/chicken, the figure suggests an increasing trend. That is, the price of pork has increased relative to chicken.

On the other hand, a stationarity test was applied to the series of relative prices of live chicken and in carcass. The series is shown in Figure 10.7:

Figure 10.7. Relative price of chicken meat carcass/live, 1980-2016



Source: SIAP.

The tests indicate that the series is stationary. This result is consistent with the gross margin resulting from prices in both links. Table 10.2 shows that the average gross margin was 30.6% between 1980-1989, decreased between 1990 and 2009; and recovered between 2010 and 2016, to reach 30.7%. These data are important because they indicate that the margin of the processors seems not to have varied significantly.[88]

Table 10.2. Gross margin, chicken carcass/live chicken

Period	Gross margin
1980-1989	30.6%
1990-1999	28.8%
2000-2009	26.8%
2010-2016	30.7%

Source: SIAP.

10.4. Mean difference analysis of final prices

A test of mean difference between entities was carried out, in order to identify price differences between regions and to group entities.

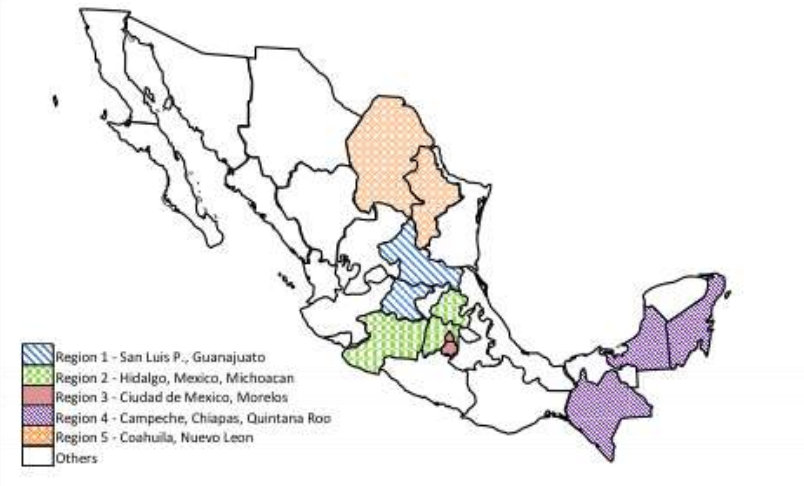
INEGI provides consumer price information, from January 2011 to March 2017, for 49 cities, located in the 32 states. The information is distinguished by product type. Prices were taken per kg of whole chicken, observations above MNX per kg were eliminated and simple averages were calculated for each state per month.

[88] The only information on profitability is published by Industrias Bachoco, which indicates that in 2016 it had an EBITDA of 11.1%, 12.7% in 2015 and 14.7% in 2014. It is difficult to compare this result, since public companies from other countries, also offer other products besides chicken meat. See Industrias Bachoco, S.A.B de C.V., Informe anual 2016, https://corporativo.bachoco.com.mx/wp-content/uploads/2017/04/Bachoco-Informe-Anual-2016.pdf

In order to carry out the exercise, regions covering several candidate states were formed, taking into account the following criteria: similarity of means, contiguity of entities and existence of processing plants.

From the application of tests of mean differences, it was determined that statistically it is possible to group only five regions, illustrated in the following figure:[89]

Figure 10.8. Regions grouped according to the mean difference test for the price of whole chicken in Mexico



Source: INEGI.

The rest of the states cannot be grouped. The complete results are reported in the annex.

Table 10.3. Whole chicken average real price, per region, 2011-2017 (Dec 2010=100)

Region	Average Price	Standard deviation
Colima	36.9	2.61
Zacatecas	36.5	3.46
Jalisco	34.7	1.61
Sinaloa	34.6	1.83
Querétaro	33.6	2.08
Coahuila Nuevo León	33.4	2.05
Baja California Sur	33.4	1.5
Ciudad de México Morelos	32.7	2.04
Durango	32.7	3.66
Tabasco	32.7	2.82
Guanajuato San Luis Potosí	32.6	1.83
Oaxaca	32.4	2.19
Chihuahua	32.4	2.3
Nayarit	32.2	1.82

[89] Only data for 2015 and 2016 were used for the conformation of the Hidalgo-Estado de Mexico-Michoacán and Coahuila-Nuevo-León regions.

Region	Average Price	Standard deviation
Baja California Sur	32.1	4.41
Hidalgo Estado de México Michoacán	31.7	1.81
Tamaulipas	31.6	2.38
Aguascalientes	31.4	2.12
Puebla	31.4	1.76
Yucatán	30.6	1.91
Guerrero	29.4	2.56
Sonora	29.2	1.4
Campeche Chiapas Quintana Roo	29.1	2.12
Veracruz	28.5	1.95
Tlaxcala	28.2	2.44

Source: INEGI.

Processed chicken is transferred from the plants to consumption centres located in nearby states. Through the information provided by SNIIM, it is possible to verify that whole chicken consumed in Zacatecas comes from San Luis Potosí and Aguascalientes, neighboring states. Nayarit is supplied by Sinaloa, an adjoining state. Mexico City receives chicken from Querétaro, Guanajuato and Veracruz, states located less than five hours away. It also receives from Coahuila, as Pilgrim´s-Tyson has important facilities there. This is the only case reported by the SNIIM, of transfer longer than five hours.

Although the supply comes from neighboring entities, the results indicate that in the final link, from marketing to the consumer, the entities follow particular price formation mechanisms. Several interviewees pointed out that in determining prices, in addition to the origin of the product, local phenomena are decisive. In this way, the existence of different average prices is indicative of the existence of local markets.

10.5. Conclusions

Since the 1990´s consumer prices of poultry meat have declined in real terms by approximately 40%, compared to the National Consumer Price Index.

In order to know more about the mechanisms of price formation between the links in the chain, several statistical exercises were carried out to determine relative prices, with information provided by SNIIM, INEGI and SIAP.

First, we analysed stationarity of relative prices between some inputs (yellow corn, sorghum and soybean paste) and balanced feed, which is used by approximately one-third of the market. The conclusion is that the prices of the grains are not different from the trajectory of prices of the feed. For its part, soy paste has increased faster than balanced feed. In summary, the feed link has not noticeably increased prices above its costs related to inputs.

Second, the price relationship between balanced feed and chicken in the wholesale channel was analysed, taking into consideration the price of the whole chicken in distribution centres in Mexico City. The information indicates that the relative price is stationary, that is, there are no asymmetries in the behaviour of the prices of both products.

Third, the behaviour of the relative price between the whole chicken in the wholesale channel and the final consumer was analysed. Again, the series was stationary.

This exercise of relative prices indicates that there is stationarity between the prices of some of the links that make up the value chain. This means that, from the statistical point of view, one of the links has not perceptibly raised its prices above others. In economic terms, this indicates that there are no changes in the power of negotiation between links.

The behaviour of beef, pork and chicken meat prices since the 1980s was also analysed. During this period, the real price of chicken decreased by more than 50%, live and in carcass. Although the prices of beef and pork meat have also declined, they declined less than chicken meat.

As for the gross margin, between 1990 and 2010 there was a significant decline compared to the 1980s, but in the 2010s there was a recovery.

Finally, a mean difference analysis was carried out to study price behaviour at the local level. The exercise concluded that there are five regions in which prices are likely to be influenced by common elements. These regions represent 12 states of Mexico. In the rest of the states, the information indicates that it is possible that the formation of final prices is affected by different local aspects. This, coupled with the diversified location of TIF slaughter plants and the need for rapid mobilisation of fresh poultry to their places of consumption, indicate that markets may be local or regional.

Chapter 11. Final conclusions

Overview of the industry

The consumption of meat has increased in recent decades. Among the types of meat, chicken has had the greatest expansion, at least over the last 30 years. Among other reasons, this is due to the ease with which it is accepted by different cultures and the lack of religious restrictions; the development of industrialised, automated and standardised industrial systems; and the reduction of price, in real terms and in relation to other types of meats. In addition, the production of chicken meat has advantages over beef and pork, which are the other most consumed meats in the world. Chicken production is less intensive in the use of various resources and inputs, such as water, land and food, and has lower production costs.

Forecasts indicate that expansion in the consumption of chicken meat will continue, particularly in low- and middle-income countries, in which an improvement in the population's income and growth is expected. It is possible that by 2025, Mexico will face a growth in demand of around 20%, which should be addressed through the expansion of production or imports. It is thus important that the country implements policies facilitating the expansion of production, and focusing on the demand for inputs; particularly corn.

To implement these policies, it is necessary to improve knowledge about the operation of the production chain. In Mexico, a modern agro-industrial model prevails, sharing its main characteristics with those observables in developed countries. This model requires the co-ordination of diverse activities: the production of fertile egg, the raising of chickens on farms, and their processing, distribution, and commercialisation. A fully proficient model requires logistical co-ordination but also the application of techniques for the efficient integration of the different activities. Both permanent and synchronised flows of inputs between the links are required (breeding flocks, fertile egg, farm chicks, chickens for slaughter, food, medicines and vaccines) and large investments. Although the model favours concentration in production, in this study there was no evidence of notorious imbalances in the relative prices between the links.

This model is related to an undetermined percentage of the demand, probably higher than 50%. The rest of the market is supplied by smaller economic units, which serve consumers through traditional sales channels and practices that have not been subject to systematic analysis.

This duality of market makes the analysis complex. There are vertically integrated companies, from the production of the fertile egg and the fattening of chicks to the operation of distribution centres. There are also modalities in the relationship with farms, some of which belong to large economic groups while others operate through different contractual models. There is also a distinction among integrated producers that produce balanced feed. This, together with other elements, is indicative of different cost structures, as well as size asymmetries among the economic agents operating along the chain.

International context

The international panorama is relevant for the study of the market in Mexico. Almost 60% of world production is concentrated in four regions: the United States, China, Brazil and the European Union. International trade takes place among countries whose production complies with sanitary standards as there is widespread concern about preventing the trade of chicken from countries that do not guarantee compliance with these standards. Mexico appears as a relatively smaller producer, contributing only 3% of global production. Likewise, the country has a deficit in chicken and imports approximately 20% of its apparent consumption.

International evidence shows that there is a high correlation between the prices of cereals that are used for feeding birds, mainly corn, and the price of chicken meat. In fact, the cost of food for chickens is considered to be the main determinant of the price of chicken meat. The relationship between meat production and grain consumption has led countries such as India to plan to meet an increase in the demand for chicken meat in the coming years by increasing their meat production and the cultivation of grains, mainly from corn, to cover the feeding needs of the birds.

General characteristics of the industry in Mexico

The production of chicken meat accounts for almost half of total meat production. The market has expanded at a rate of 2.8% since 2003. Most of the production (51%) is concentrated in five states: Jalisco, Veracruz, Aguascalientes, Querétaro and Durango.

Per capita consumption has increased significantly. It has tripled since the beginning of the 1990s and it could grow by 10% by 2025. This, combined with population growth, could result in an apparent consumption increase of around 20%.

The value of imports has increased by 140% between 2003 and 2016 and represents 20% of apparent consumption. Almost 50% of the imports are chicken pieces, primarily leg and thigh and come mainly from the United States. Imports from non-trading countries are subject to 75% tariffs. There is no information about the groups involved in the importation of chicken meat. It is possible that some of them represent a considerable volume, which allows them to represent a competitive force in the market.

Demand growth must be met through increased production or imports. As for production, it is possible that expansion would produce a greater demand for grain, particularly yellow corn. In this sense, to stimulate the production of chicken meat, but also of other species, it is necessary to improve the conditions of production of grain in Mexico.

The country imports fertile eggs. Imports have increased almost 500% since 2012, due to the decline in domestic production among other reasons. Some interviewees pointed out that it is possible to improve the logistical conditions to speed imports (e.g. customs services) of this product, which requires special handling. They also indicated that the country has lost competitiveness in the production of fertile eggs, due to the emergence of sanitary crises, which led to a transfer of national production to other countries. In this regard, it is important that the country reinforces the measures of detection, reporting and attention to emergency situations, to improve its capacity to contain the spread of infection. Some interviewees expressed the need to have a system that encourages timely reporting of emergency situations by farms. Some producers have been working on the design of a private insurance system.

The relationship between integrators and farmers

In countries such as the United States, the relationship between integrators and farmers is developed through contracts that: i) specify the distribution of risks; ii) allow the transmission of technological progress and knowledge; iii) establish the operational bases to obtain product of uniform quality; and iv) serve to guarantee access to credit. They also establish the remunerations obtained by farmers and the operating conditions of tournaments in which farms compete in terms of productivity. Tournaments allow integrators to establish a performance-based compensation system and solve the problem of observability of the farmers' effort. It is known that in Mexico there are similar contractual schemes, although there is also vertical integration between processors and farms.

Farms are in areas close to processing plants. Under conditions of market concentration at the local level in processing activities, farmers may be vulnerable in their relationship with processors because of: i) the lack of hiring options with other processors; ii) the specificity of the investments made by the farmers, making switching more expensive; and iii) the lack of a guarantee of renewal of contracts. This means risks of renegotiation of contracts, which under conditions of perfect information would lead to a level of underinvestment on the part of the farmers. However, some studies indicate a certain myopia on the part of some farmers, who do not have the capacity to envisage future changes in the conditions of the chicken meat market. This situation has led to complaints from farmers regarding asymmetries in bargaining power.

In countries such as the United States, the authorities have a record of contracts between farmers and processors, which indicates the effect of the concentration of the processing market on the remuneration that farmers receive, and shows the impact that other variables have on their income. In Mexico, it is not possible to determine the existence of a commitment problem, because there is no information about the number of farms, their location or their contractual relationship with processors.

What is known in Mexico is that some processing companies, such as Bachoco, have been vertically integrated into the operation of farms. Apparently, this was a result of the difficulties of access to credit in the country several decades ago, which made it impossible for farmers to develop their existing assets through investment. The document analyses the experience of La Laguna, the only model of sharecropping on which public information is available. For more than 30 years, there has been a strategic alliance between producers primarily in the social sector and the Pilgrim´s-Tyson company. The scheme that operates the strategic alliance between Pilgrim´s-Tyson and producers of the social sector has contractual similarities with the schemes used in the United States, including the existence of tournaments. La Laguna’s distinctive element is the participation of FIRA, who intervene to establish conditions that guarantee the adequate provision of chickens to the farms, so that social producers maintain the flow of income necessary to fulfil their credits.

La Laguna is successful because: i) it involves producers in the social sector; ii) it is a contractual association scheme, in which the risks of renegotiation have been limited; iii) it is financially viable; iv) it has helped generate income for farmers; and v) has solved a problem of the use of natural resources (land, water) in the region.

The supply of day-old chicks

At the level of links in the chain, the analysis begins with the process of production of genetic lines. The industrial production of chicken meat requires the permanent and synchronised provision of large volumes of fertile eggs for incubators and day-old chicks for farms. Three transnational companies provide these inputs, and have been producing genetic varieties for several decades using different tools.

The business model of these companies is based on obtaining pure lines. Genetics companies supply fertile eggs or chickens for integrators and farms. Integrators can operate breeding farms, with inputs provided by genetics companies. For reasons of cost, health care and business models, genetics companies facilitate the installation of breeding farms only near those integrators who operate on a large scale.

Interviewees indicate that large integrators operate as distributors of genetics companies in Mexico or that their parent companies are investors in genetics companies. There is no information to document whether independent farms have acceptable access conditions. According to some interviewees, it is possible that when there is high demand, suppliers give preferential access to larger customers. However, it is also possible that the relationship between integrators and genetics companies generates incentives to take actions that hinder the access of independent producers.

Farm production

Information is available on the operation of the industrialised market segment. However, there is no information on the operation of the segment that is not linked to large processors. There is no information on the number of economic units, their location, their conditions of access to inputs and the contractual conditions of their relationship with processors. To find out about possible anticompetitive behaviours or inefficient situations, it is important to collect information systematically on the operation of the segment.

The industrialised segment is mainly made up of a few integrating companies, operating directly or via contracted farms. These companies are also vertically integrated with heavy reproduction farms, which require large investments and the collaboration of genetics companies, who provide shelters for reproduction. In addition, integrating companies have incubators, slaughtering facilities and facilities to produce balanced feed.

The installation of a farm must meet various technical, sanitary and legal requirements. The interviewees indicated that uncertainly over land rights could discourage investment. The interviewees also indicated a lack of clarity in applying the provisions that govern the distances between farms, human settlements and other facilities. The problems are twofold. First, federal regulation comes from administrative agreements, which supplement the functions of the official rules, but lack sufficient capacities for application and sanction. Second, the application of regulatory measures or administrative provisions by local authorities in territorial matters sometimes follow principles that are not compatible with federal regulations.

Feeding

The cost of feed is the main cost of poultry production. That is why the large integrating companies are owners of facilities to produce balanced feed. The obstacles in accessing food were not identified, although non-vertically integrated companies are at a cost

disadvantage. About one-third of the birds receive commercial feed, that is, vertical integration with food production takes place for two-thirds of the market.

Yellow corn is the main component of the bird feed, although white corn can also be used. Integrating companies mobilise large volumes of grain, which gives them an advantage in transport costs. Yellow corn comes mainly from the United States, as Mexico is not self-sufficient in this product. In this sense, having local sources of grain supply would help to reduce logistical costs.

Use of antibiotics

In Mexico, the *Manual of Good Livestock Practices* of the industry establishes that antibiotics should not be used for preventive purposes or to improve growth. However, this manual is not mandatory, and only companies wishing to certify that they follow the best livestock practices are required to show they do not use antibiotics for these purposes. It should be noted that only a little more than 100 farms are certified. The government should define whether antibiotics are prohibited for the designated uses and, if appropriate, monitor the implementation of the measure. There is a meat inspection system that focuses on the analysis of meat from other species. Chicken meat samples are limited, so it is not possible to know if there is an issue of antibiotic contamination.

Processing

There are official standards related to the operation of TIF plants, which regulate installation, processing and sanitation conditions of plants. The industry applies control mechanisms, including the HACCP tool.

Slaughtering in plants represents a maximum of 57% of total slaughtering. There are 34 TIF establishments for chicken slaughter distributed throughout the country. It is known that slaughtering in this type of plant represents 88% of the processing in-plant.

Distribution and marketing

The final product reaches the market in various forms through different channels. Trade in live birds makes up 38% of product. There is reason to think that competition in downstream markets is working and the product reaches the consumer through various specialised retailers, public markets, over-the-counter markets, grocery stores and supermarkets. Likewise, there is slaughter at the point of sale and domestic slaughter. The modern distribution channel represents a low proportion of consumption, approximately 15%.

Concentration

It has already been pointed out that the information available on the number of farms does not indicate how many actually exist. It is known that there has been an increase in concentration, as according to industry data there are fewer small companies than in 1996 and the larger ones comprise a larger proportion of the market.

Regarding commercialisation, available information indicates that there are 632 wholesale chicken dealers; more than 46 000 chicken outlets; more than 6 000 self-service stores and more than 600 000 grocery stores and other types, of which an undetermined proportion is known to be involved in retail chicken marketing.

Barriers to entry

The conditions for small and medium-sized farms to access genetic lines and fertile eggs are unknown. On the other hand, it is costly for a farm to be vertically integrated into breeding and hatching activities as well as processing. All these activities require large specific investments that represent sunk costs. In terms of processing, companies need to establish a "production train", that is, a significant number of farms supplying live animals, which guarantees the permanent supply of animals for slaughter.

According to some interviewees, processors may face limitations in accessing the modern channel, due to the existence of practices such as category management, captaincy category and fee allocation. There is no information to document these behaviours.

Retail marketing of poultry does not require significant investment. It is performed in various facilities, some lacking regulation. However, some interviewees indicated that there are difficulties in marketing the processed product when it comes from another location due to the imposition of unjustified charges by local authorities.

Collaboration between competitors

Several jurisdictions allow collaboration between competitors in agricultural activities. One of the principles under which this collaboration operates is that it should not reduce competition or supply. The provisions that allow this do not detract from the activities of the competition authorities. In Mexico, there are no laws that explicitly allow collaboration. It is important to analyse the desirability of having provisions for collaboration, not only in this industry but also in agricultural markets in general, since in other countries the association between producers has been a successful route that has allowed the realisation of joint investments and has led to a better income for the primary producers.

Prices and margins

Since the 1990s, chicken prices have declined by almost 40% in real terms. However, in recent years there has been a slight rebound. Whenever demand growth is expected to continue and supply has not grown at the same rate, it is important to evaluate alternatives to avoid this situation which generates pressure on prices.

This report includes various statistical exercises to test the stationarity of relative prices, particularly in the case of: i) some inputs (yellow maize, sorghum and soybean paste) and balanced feed; ii) balanced feed and chicken in the wholesale channel; and iii) whole chicken in the wholesale and the final consumer channels. The behaviour of beef, pork and chicken prices has also been analysed since the 1980s. Finally, a mean difference analysis was carried out to obtain information about the way in which final prices are set at the geographical level. Thus, although the exercises do not constitute an integral effort to model a price transmission system, they do provide results that shed light on some aspects of market behaviour.

The tests of stationarity between industry links indicate that there has been a lag in the price of grain (yellow corn and sorghum), compared to the price of balanced feed. This result is consistent with what has been pointed out in several studies that have analysed agro-industrial chains, which have concluded that the primary production links, which are usually the most atomised, face disadvantages compared to industrialised production links, which are usually more concentrated. The production of balanced feed is a concentrated

activity, in which two-thirds of production meets the consumption needs of large processors. As for the rest of the links, no asymmetry is perceived. That is, the prices of the balanced feed and chicken in wholesale and final consumer channels, have similar trajectories. However, this does not mean that there can be no changes in the profit margins, particularly in the most efficient links and producers.

The analysis of the prices of different types of meat shows a clear reduction in the price of poultry meat in relation to beef and pork meat since the 1980s. The comparison between live and carcass chicken confirms the result of the previous paragraph, in the sense that the price relation between these two links is maintained. The information allows us to analyse the gross margin in the production of chicken meat. Between 1990 and 2010 there was a significant drop in the margin compared to the level prevailing in the 1980s, but from the 2010s there was a recovery. The only information on profitability is published by Industrias Bachoco, which indicates that in 2016 it had an EBITDA of 11.1%. It is difficult to compare this result, since public companies from other countries also offer other products besides chicken meat.

Regarding the possible grouping by region, the exercise tentatively concluded the existence of five areas, which group entities in which price formation may have some common elements. These regions represent 12 entities. In the rest of the states, the information indicates that it is possible that the formation of final prices depends on different local aspects. This, coupled with the diversified location of TIF slaughter plants and the need for rapid mobilisation of fresh poultry to their places of consumption, indicates that markets may be local or regional.

Chapter 12. Recommendations

In light of the elements presented above, the following recommendations have been formulated, which aim to improve the operational efficiency of the chain.

Proposal 1

Situation: The relationship between farms and processors is important since it can affect the distribution of risk between the parties and affect investment decisions. In countries such as the United States, information systems allow for studies to determine the existence of competition in production and processing. It has been found that farmers receive better compensation when they have greater options for marketing their services. Competition between processors dilutes the risk of a commitment problem.

In Mexico, there is no public information about the contractual modalities and the characteristics of such a relationship. It is not possible either to determine if there could be a commitment problem, or to determine the options available to farmers. Nor is it possible to assess the existence of barriers to entry.

Recommendation: To create a registry of contracts between farms and processors, which provides information on aspects such as: payments; the type of contractual relationship; the terms contracted; the possible relationship of exclusivity; control of economic agents, both on the side of farms and processors; and the terms of the supply of inputs. The information collected could be made available to the public, ensuring confidentiality to avoid disclosure of the identity of economic agents so that the information is not used for anti-competitive purposes.

Proposal 2

Situation: During the investigation, it was found that there is no public information about the number of breeding and producing farms, their location, their capacity or economic groups. This lack of information provides no more detail on the value chain. It is also not possible to determine the degree of vertical integration, between the links of reproduction, growing and processing. This can be an element that limits the application of effective public policies, in the improvement of productivity, market concentration and the prevention of health emergencies.

In countries such as the United States there are censuses, databases and surveys that allow the authorities to determine the degree of geographical concentration of the links; to apply biosecurity measures; to plan and act more accurately in cases of emergency; and to adopt measures to control farm waste, among issues.

The information collected also includes indicators of financial conditions, productive practices and welfare on the farms. Likewise, it is possible to carry out studies on the regional concentration of production, the evolution of production and feeding costs. There

are also databases that provide information on the ownership and property changes of farms and processing plants. An example of the information systems available in the United States is the USDA Agricultural Resource Management (ARMS) report.

Recommendation: To strengthen the information collection systems of productive units, mainly farms and processing plants. Such an information system should, at least, collect and publish information that provides information on the number of breeding and producing farms; their capacity; location; and what economic group they belong to. The information collected could be made available to the public, ensuring confidentiality to avoid disclosure of the identity of the owners and that the information is not used for anti-competitive purposes.

Proposal 3

Situation: A significant part of the demand for chicken is met by meat from undocumented processing mechanisms. Traditional slaughtering practices prevail in the market, particularly in low-income localities, as there is a significant preference for "hot" meat and live chicken. This means that there is neither control over the slaughter, transfer or marketing procedures, nor over disposal of the waste, which implies health risks.

Recommendation: More in–depth information is required about the operation and structure of the non-modern segment of the market, to be able to propose public policy measures. It is necessary to collect information on the size of activities, the economic agents involved and their location, among other things.

Proposal 4

Situation: The gap between demand and chicken production has grown. In 2016, imports represented around 20% of apparent consumption. Information is needed about the structure of imports, particularly in terms of identifying the main economic groups that carry out these activities. A high concentration of importers could mean that some group is of greater importance than domestic producers. In case imports are made by the same economic groups that produce in Mexico, the disciplinary capacity of imports in the market could be diminished.

Recommendation: A study should be conducted to identify the main economic groups that participate in imports, to determine their impact on the structure of the market.

Proposal 5

Situation: In other countries, there are mechanisms that allow collaboration among competitors in the agricultural sector. In Mexico, the legal framework may be insufficient to favour co-operation, which would reduce costs and enter the market jointly. In the case of cereal producers, the possibility of engaging in complementary activities, such as the production of balanced feed, possibly with the collaboration of meat producers, is one way of going forward.

Recommendation: Favourable measures should be adopted for collaboration between agricultural producers, in the field of tax and competition provisions. This would allow them to reach a higher productive scale, as well as facilitating their integration into other links, related to processing and distribution. At the same time this would ensure active competition, including the relevant application of competition laws.

Proposal 6

Situation: Feed, and in particular corn, are the main determinants of production costs and by extension, the price of chicken meat. The probable increase in demand over the next few years will increase the pressure on grain production and imports.

Recommendations: i) To stimulate the expansion of productive capacity and productivity in the cultivation of corn; ii) to focus the improvement effort on productivity in the areas close to the largest consumption centres; iii) to disseminate, through institutional channels and in collaboration with private and non-governmental organisations, the best agricultural practices; iv) to stimulate the development of an improved seed market, taking advantage of the work of institutions such as the International Maize and Wheat Improvement Center (Centro International de Mejoramiento de Maíz y Trigo – CIMMYT).

Proposal 7

Situation: The participation in processing requires guaranteed and continuous access to poultry. This limits the possibilities for farmers to expand into processing activities. Also, the possibility of a commitment problem could inhibit investment in farms. The study presents the successful experience of a collaborative project in La Laguna between a private company, social producers and FIRA, , where alternative activities were offered to agricultural producers who were given access to the necessary credit to make investments. The scheme minimised uncertainty about the demand for farm services, guaranteed the recovery of credits and generated an expectation of improvement in the income of social producers. There were also benefits for the private company, which reduced its investment requirements and diversified its sources of supply.

Recommendation: To deepen the analysis of successful experiences of productive collaboration, to transfer its favourable aspects to other territories with other economic agents.

Proposal 8

Situation: The tariffs applicable to countries other than those with which there is a commercial treaty have decreased, although they maintain a high level of 75%. The costs of chicken carcasses in the Americas show significant differences; the United States and Mexico have the lowest costs. It is possible that this means that the costs of processed chicken from countries other than the United States are higher, and the tariff makes imports from other countries even more expensive.

On the other hand, there is a tariff-rate quota, which allows the importation of up to 300 000 t, effective until December 2019. This measure has made it possible to import from countries other than the United States and has made it possible to mitigate the effect of sanitary emergency situations. However, the tariff-rate quota is a temporary measure that can be reversed. It is better to eliminate import restrictions and expand options for consumers, particularly if demand growth is expected to continue.

Recommendation: To establish zero tariffs on the import of chicken meat products.

Proposal 9

Situation: The regulation of some structural aspects of the industry, such as restrictions on location, is carried out through administrative agreements issued by the sectoral authority. These agreements were established to provide the authority with flexibility to act quickly in the case of emergency situations and were not designed to be used as instruments to establish the rules of operation of the markets in the long term.

The agreements can be modified without formal procedures of analysis and public consultation. In the same way, they may be left behind or not adhere to international best practices. It has even happened that, through administrative agreements, official rules have been replaced. This has generated confusion for the participants in the industry. The agreements have weak legal mechanisms to guarantee their enforcement regarding instruments such as Official Mexican Standards (Normas Oficiales Mexicanas, or NOM).

There is no specific regulation that distinguishes breeding farms from producing farms. Establishing specific regulations can be a mechanism to encourage the establishment of breeding farms, which can generate alternatives to fertile egg imports.

Agreements have replaced the NOMs regarding the location and distances of the farms from the population centres and roads. The agreements have fewer possibilities for application and legal defence than the NOMs and favour contradictory actions by local authorities in matters of territorial ordering.

Recommendations: i) To issue NOMs in relation to the regulation of the location of farms and distances from roads and human settlements; ii) to issue NOMs that distinguish between breeding and fattening farms; iii) to promote NOMs as the only mechanism to determine the rules of operation of the markets in the long term.

Proposal 10

Situation: A high concentration of genetic lines are used in the industry, since three transnational companies control the supply. One of them represents 70% of provision. These companies maintain distribution relationships with the main producers of chicken meat. The commercial terms of the relationship are unknown.

There is no evidence of any type of exclusionary behaviour against independent farms. However, the interviewees pointed out that, in situations of high demand or shortage of input, suppliers give preference to the largest producers.

Recommendation: Regulatory and competition authorities should consider the concentration in the market of the provision of the genetic lines and the relationship of the supplying companies with the integrating companies as an element to be evaluated in their procedures.

Proposal 11

Situation: There is a worldwide debate about the use of antibiotics in the industry, particularly for the prevention of diseases and to improve growth. Mexico has expressed the intention to avoid the use of antibiotics for growth purposes. However, the provision comes from the *Manual of Good Livestock Practices* of the industry and its application is voluntary, although companies can choose to obtain certification. According to the interviewees, there are few certified companies.

On the other hand, there is no a verification system for chicken meat, within the coverage of other export meat products, so there are no instruments to detect the antibiotic content of chicken meat.

Recommendations: i) To implement a system of regulation and controls, through a NOM that guarantees the application of protocols that prevent the product from reaching consumers with an excess of antibiotics or other contaminants; ii) to review the validity and concordance of the *Manual of Good Livestock Practices* with the best international practices; iii) to establish the obligation to apply the *Manual* and obtain certification.

Proposal 12

Situation: There are no NOMs for the classification of livestock, including chicken. There are Mexican standards, although they are not mandatory. The lack of official standards means that consumers cannot distinguish between different characteristics and qualities of the product. Likewise, there are few incentives for voluntary certification and compliance with provisions such as the *Manual of Good Livestock Practices*.

There may be a brake on investment because of the lack of clarity about the rules applicable for entering a business producing organic products, which is a segment that has developed in other countries. Likewise, export possibilities are reduced, as there are no guarantees that the requirements of other markets are met.

Recommendation: To issue a NOM for classifying chickens in carcasses.

Proposal 13

Situation: There is a high geographical concentration of production in five states: Jalisco, Veracruz, Aguascalientes, Querétaro and Durango, which represent around 60% of total production in Mexico. The high concentration, coupled with the fact that the production of chicken in the indicated locations coincides with the installations of other types of products (egg, pork) can represent health risks and contamination of natural areas and groundwater. Such a high concentration requires the application of stricter sanitary policies. For example, the improper handling of waste on a farm can produce a problem of greater contamination that affects the rest of the producers.

Recommendations: i) To review the best international practices, regarding the installation of farms and production density, to reinforce the applicable regulatory measures; ii) to design mechanisms that stimulate the timely reporting of infectious outbreaks; and iii) to strengthen timely attention that allows the quick release of the facilities after closure, so that the companies can re-establish their operations as soon as possible.

Proposal 14

Situation: The preservation of the cold chain is fundamental to guarantee the safety of the product. Fresh chicken is a particularly sensitive product and must be consumed quickly. The information obtained in the investigation indicates that the TIF slaughter maintains the cold chain until distribution. From there, the conditions of the cold chain are uncertain. For example, there is an extended practice of transporting the product in open vehicles to the stores for sale.

The Regulation on Sanitary Control of Products and Services in force regulates activities, services and establishments related to meat and its products. Article 28 states that, during

transport, perishable foods must be kept at refrigeration temperatures and frozen foods must be kept in that condition. The regulation does not prohibit the transfer of products in the open air, nor is there a regulation on the specific requirements that vehicles must satisfy.

Recommendations: i) To issue a NOM on the transport of perishable products, in accordance with the best international practices; ii) to strengthen the administrative capacity of the verifying authorities of the cold chain, to enable them to carry out more preventive actions.

Bibliography

American Antitrust Institute (2008), “Fighting Food Inflation through Competition”, en The Next Antitrust Agenda: The American Antitrust Institute´s Transition Report on Competition Policy to the 44th President of the United States, https://antitrustinstitute.org/files/Food%20Chapter%20from%20%20AAI%20Transition%20Report_100520082051.pdf

Babula, R, D. Bessler y G. Schluter (1990), "Poultry-Related Price Transmissions and Structural Change since the 1950's", Journal of Agricultural Economics Research, 42(2), http://ageconsearch.umn.edu/bitstream/139018/2/4Babula_42_2.pdf

Barbut, S. (2015), The Science of Poultry and Meat Processing, http://www.poultryandmeatprocessing.com

Barrett, C. y J, Fabiosa (1998), "A Policy Model for the Livestock and Poultry Sectors of Mexico", CARD Technical Reports, Iowa State University, http://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1033&context=card_technicalreports

Casani, S., M. Rouhany y S. Knøchel (2005), "A Discussion Paper on Challenges and Limitations to Water Reuse and Hygiene in the Food Industry", Water Research, (39), https://eurekamag.com/pdf.php?pdf=004016669

Castañeda, M. y otros (2013a), Calidad microbiológica de la carne de pollo, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, http://www.anetif.org/files/pages/0000000034/19-calidad-microbiologica-de-la-carne-de-pollo.pdf

Castañeda, M. y otros (2013b), Carne de pollo mexicana, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, http://www.anetif.org/files/pages/0000000034/15-carne-de-pollo-mexicana.pdf

Cleary, J. (2013), "Water Reuse Trends in Pharmaceutical and Food & Beverage Industry", Industrial Water Reuse Specialty Conference Session A3. Long Beach, California, http://www.hdrinc.com/sites/all/files/content/

presentations/presentation-files/5957-water-reuse-trends-in-pharmaceutical-and-food-beverage-industry.pdf

COFECE (2015a), Expediente CNT-088-2014, http://cofece.mx/CFCResoluciones/docs/Concentraciones/V704/0/2070270.pdf

COFECE (2915b), “Criterios Técnicos para el cálculo y aplicación de un índice Cuantitativo para medir la concentración del mercado”, Diario Oficial de la Federación, 14 de mayo de 2015, http://www.dof.gob.mx/nota_detalle.php?codigo=5392185&fecha=14/05/2015

COFECE (2015c), "Reporte sobre las condiciones de competencia en el sector agroalimentario", https://www.cofece.mx/cofece/images/Estudios/COFECE_reporte%20final-ok_SIN_RESUMEN_ALTA_RES-7enero.pdf

COFECE (2016a), "Evaluación del impacto en el bienestar de los consumidores derivado de la sanción a cárteles en el mercado de pollo", https://www.cofece.mx/cofece/images/Micrositios/Evaluacion_ex_post_pollos.pdf

COFECE (2016b), Análisis de práctica monopólica absoluta, investigación y sanción a colusión en la industria avícola, https://www.cofece.mx/cofece/images/Promocion/Historias/Historia_Pollos_280316.pdf

COFEPRIS (sf), "Guía de buenas prácticas de higiene en establecimientos de servicio de alimentos y bebidas", http://www.cofepris.gob.mx/AS/Documents/COMISIÓN%20DE%20OPERACIÓN%20SANITARIA_Documentos%20para%20publicar%20en%20la%20sección%20de%20MEDICAMENTOS/ALIMENTOS/GUIA%20ALIMENTOS%20FINAL1.3.1.pdf

Comisión de las Comunidades Europeas (2008), "Hacer frente al reto del alza de precios de los productos alimenticios orientaciones para la acción de la UE", http://eur-lex.europa.eu/legal-content/ES/TXT/?uri=CELEX%3A52008DC0321

Comisión de las Comunidades Europeas (2009a), "Mejorar el funcionamiento de la cadena alimentaria en Europa", http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0591:FIN:ES:PDF

Comisión de las Comunidades Europeas (2009b), "Los precios de los productos alimenticios en Europa", http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0821:FIN:ES:PDF

Comisión de las Comunidades Europeas (2009c), “A Better Functioning Food Supply Chain in Europe”, COM(2009) 591 final, http://ec.europa.eu/economy_finance/publications/pages/publication16061_en.pdf

Department of Justice-USDA (2010), Public Workshops Exploring Competition in Agriculture, Poultry Workshop, 21 de mayo de 2010, https://www.justice.gov/atr/events/public-workshops-agriculture-and-antitrust-enforcement-issues-our-21st-century-economy-10

Department of Justice (2012), "Competition and Agriculture: Voices from the Workshops on Agriculture and Antitrust Enforcement in our 21st Century Economy and Thoughts on the Way Forward", https://www.justice.gov/sites/default/files/atr/legacy/2012/05/16/283291.pdf

Dicks, M. (2010), “Concentration and Competition in the Poultry Industry”, The Department of Justice and the U.S. Department of Agriculture (USDA) second joint public workshop on competition and regulatory issues in agriculture held on May 21, 2010, https://www.justice.gov/sites/default/files/atr/legacy/2010/06/03/AGW-15685-a.pdf

Directorate-General for Competition (2016), An overview of European competition rules applying in the agricultural sector, http://ec.europa.eu/competition/sectors/agriculture/overview_european_competition_rules_agricultural_sector.pdf

Dong, D. y B. Gould (2000), "Quality Versus Quantity in Mexican Household Poultry and Pork Purchases", Agribusiness, 16(3), https://eurekamag.com/pdf.php?pdf=003539214

Elam, T. (2010), "Competition in the U.S. Chicken Sector", FarmEcon LLC, http://www.farmecon.com/Documents/USDA-DOJ%20Chicken%20Sector%20Competitiveness%20Study%20FARMECON%20LLC%205-19-2010.pdf

Elam, T. (2016), "Live Chicken Production Trends", http://www.nationalchickencouncil.org/wp-content/uploads/2016/04/Live-Chicken-Production-FARMECON-LLC-FINAL-April-2016.pdf

El Colegio de México (2017), Estudio del mercado de producción, procesamiento, distribución y comercialización de la cadena de maíz-harina/nixtamal-tortilla en México.

Elfick, D. (sf), "A Brief History of Broiler Selection: How Chicken Became a Global Food Phenomenon in 50 Years", http://cn.aviagen.com/assets/Sustainability/50-Years-of-Selection-Article-final.pdf

Farrelly, L. (1996), "Transforming Poultry Production and Marketing in Developing Countries: Lessons Learned with Implications for Sub-Saharan Africa", Department of Agricultural Economics, Michigan State University, International Development Working Papers, http://www.aec.msu.edu/agecon/fs2/papers/idwp63.pdf

European Competition Network (2012), "Report on Competition Law Enforcement and Market Monitoring Activities by European Competition Authorities in the Food Sector", http://ec.europa.eu/competition/ecn/food_report_en.pdf

FIRA (2006), "Ganadería por contrato en México: Tyson", presentación, http://www.fira.gob.mx/Nd/Esquema_AVICULTURA_POR_CONTRATO_en_La_Laguna.pdf

FIRA (2015), Panorama agroalimentario avicultura carne 2015, https://www.gob.mx/cms/uploads/attachment/file/61946/Panorama_Agroalimentario_Avicultura_Carne_2015.pdf

Hellin, J., V. Krishna; O. Erenstein y C. Boeber (2015), "India´s Poultry Revolution: Implications for Its Sustenance and the Global Poultry Trade", International Food and Agribusiness Management Review, 18, pág. 152, https://www.ifama.org/resources/Documents/v18ia/Hellin-Krishna-Boeber.pdf

Industrias Bachoco S.A.B. de C.V. (2016), Form 20-F, https://corporativo.bachoco.com.mx/wp-content/uploads/2017/04/Industrias-Bachoco-20-F-2016.pdf

INEGI, Censo Económico 2014, http://www.inegi.org.mx/est/contenidos/proyectos/ce/ce2014/

Jenner, M. (2002), Understanding the Lender's Share of Grower Contract Pay, https://www.justice.gov/sites/default/files/atr/legacy/2010/12/08/AGW-00067-f.pdf

Klein, B., V. Crawford, y A. Alchian (1978), "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process", Journal of Law and Economics 21, https://business.illinois.edu/josephm/BA549_Fall%202014/Session%202/2_Klein_Crawford_Alchian%20(1978).pdf

Knoeber, C.R. (1989), "A Real Game of Chicken: Contracts, Tournaments, and the Production of Broilers", Journal of Law Economics and Organization 5, http://ageconsearch.tind.io/record/19834/files/sp02he06.pdf

Krishna, V., O. Erenstein, P. Sadashivappa y B. Vivek (2014), "Potential Economic Impact of Biofortified Maize in the Indian Poultry Sector", International Food and Agribusiness Management Review, 14(4), págs. 111-40, https://www.ifama.org/resources/Documents/v17i4/Krishna-Erenstein.pdf

Leonard, C. (2017), "Is the chicken industry rigged?", BloombergBusinessweek, 15 de febrero de 2017, https://www.bloomberg.com/news/features/2017-02-15/is-the-chicken-industry-rigged

Lewin-Solomons, S. (2000), "Asset Specificity and Hold-Up in Franchising and Grower Contracts: A Theoretical rationale for Government Regulation", Working Paper, University of Cambridge and Iowa State University, http://www.econ.cam.ac.uk/dae/repec/cam/pdf/wp0013.pdf

MacDonald, J. y N. Key (2012), "Market Power in Poultry Production Contracting? Evidence from a Farm Survey", Journal of Agricultural and Applied Economics 44(4), http://ageconsearch.umn.edu/bitstream/137136/2/jaae562.pdf

Modificación a la Norma Oficial Mexicana NOM-008-ZOO-1994, Especificaciones zoosanitarias para la construcción y equipamiento de establecimientos para el sacrificio de animales y los dedicados a la

industrialización de productos cárnicos, en aquellos puntos que resultaron procedentes, DOF, 10 de febrero de 1999, http://sagarpa.gob.mx/normateca/normateca2/SENASICA%20NORM%2019.pdf

Nicita, A. (2008), "Avian Influenza and the Poultry Trade", The World Bank, Policy Research Working Paper Series, http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2008/03/11/000158349_20080311105630/Rendered/PDF/wps4551.pdf

Norma Oficial Mexicana NOM-251-SSA1-2009, Prácticas de higiene para el proceso de alimentos, bebidas o suplementos alimenticios, DOF, 1º de marzo de 2010, http://dof.gob.mx/nota_detalle.php?codigo=5133449&fecha=01/03/2010

Nosowitz, D. (2017), "Chicken Farmers Sue Major Producers, Calling Them A "Cartel"", Modern Farmer, 7 de febrero de 2017, http://modernfarmer.com/2017/02/chicken-farmers-sue-major-producers-calling-cartel/

OECD (2014), "Competition Issues in the Food Chain Industry 2013", DAF/COMP(2014)16, https://www.oecd.org/daf/competition/CompetitionIssuesintheFoodChainIndustry.pdf

OECD (2016), "Market Examinations in Mexico: A Manual by the OECD Secretariat", http://www.oecd.org/competition/market-examinations-in-mexico-2016.htm

OECD (2018), Estudios de evaluación de competencia de la OCDE: México, http://www.oecd-ilibrary.org/finance-and-investment/estudios-de-evaluacion-de-competencia-de-la-ocde-mexico_9789264287921-es

OECD-FAO (2016), Agricultural Outlook 2016-2025, http://www.fao.org/3/a-i5778e.pdf

Okrent, A. y J. Alston (2012), "The Demand for Disaggregated Food- Away-from-Home and Food-at-Home Products in the United States", USDA, https://www.ers.usda.gov/webdocs/publications/err139/30438err139.pdf?v=41148

Ollinger, M., D. Moore y R. Chandran (2004), "The Economic Forces Driving Food Safety Quality in Meat and Poultry", Technical Bulletin, USDA, https://www.ers.usda.gov/webdocs/publications/tb1911/17469_tb1911.pdf

Ollinger, M., J. MacDonald y M. Madison (2005), "Technological Change and Economies of Scale in U.S. Poultry Slaughter", American Journal of Agricultural Economics, 87(1), https://naldc.nal.usda.gov/download/6809/PDF

Ollinger, M. y otros (2006), "Food Industry Mergers and Acquisitions Lead to Higher Labor Productivity", Economic Research Report, USDA, http://ageconsearch.umn.edu/bitstream/7246/2/er060027.pdf

Ortega, D., H. Wang y M. Chen (2015), "Emerging Markets for U.S. Meat and Poultry in China", Choices, 30(2), http://www.choicesmagazine.org/UserFiles/file/cmsarticle_421.pdf

Ozertan, G., S. Saghaian y H. Tekguc (2014), "Market Power in the Poultry Sector in Turkey", Bogazici Journal: Review of Social, Economic and Administrative Studies, 28(2), http://www.bujournal.boun.edu.tr/docs/142926928728_2_2.pdf

Pedroza, A. (2016), La industria alimentaria animal de México 2016, Consejo Nacional de Fabricantes de Alimentos Balanceados y de la Nutrición Animal, A.C., http://cic.zoga.com.mx/pdf/nutricion-La-Industria-Alimentaria-Animal-de-Mexico-2016.pdf

Pérez, J. (2010), "Avicultura por contrato: esquema de aparcería en La Laguna", Tyson, presentación, http://www.cnog.org.mx/_documentos/4743_Avicultura_por_Contrato.pdf

Peterson, E. y D. Orden (2005), "Effects of Tariffs and Sanitary Barriers on High- and Low-Value Poultry Trade", Journal of Agricultural and Resource Economics, 30(1), http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/66658

S.A. (2006), The Structure of the United Kingdom Poultry Industry, http://labourproviders.org.uk/wp-content/uploads/2012/11/Poultry_sector.pdf

SAGARPA (2007), Ley Federal de Sanidad Animal, DOF, 25 de julio de 2007, http://www.gob.mx/cms/uploads/attachment/file/118761/LFSA.pdf

SAGARPA (2009), Manual de buenas prácticas pecuarias en unidades de producción de pollo de engorda, http://una.org.mx/english/images/yootheme/Documentos/Manuales/manualpollosengorda.pdf

SAGARPA (2010a), "Retos y oportunidades del sistema agroalimentario de México en los próximos 20 años", http://www.sagarpa.gob.mx/agronegocios/documents/pablo/retosyoportunidades.pdf

SAGARPA (2010b), "La producción de carnes en México 2010", Claridades Agropecuarias, http://www.infoaserca.gob.mx/claridades/revistas/207/ca207-19.pdf

SAGARPA (2011a), "Acuerdo por el que se da a conocer la campaña y las medidas zoosanitarias que deberán aplicarse para el diagnóstico, prevención, control y erradicación de la Influenza Aviar Notificable, en las zonas del territorio de los Estados Unidos Mexicanos en las que se encuentre presente esa enfermedad", DOF, 21 de junio de 2011, http://www.gob.mx/cms/uploads/attachment/file/108846/AcuerdoIA_21jun11__1_.pdf

SAGARPA (2011b), "Perspectivas de largo plazo para el sector agropecuario de México 2011-2020", http://www.sagarpa.gob.mx/agronegocios/Documents/estudios_economicos/escenariobase/perspectivalp_11-20.pdf

Saghaian, S., G. Özertan y A. Spaulding (2008), "Dynamics of price transmission in the presence of a major food safety shock: impact of H5n1 avian influenza on the Turkish poultry sector", Journal of Agricultural and Applied Economics, 40(3), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.573.5146&rep=rep1&type=pdf

SENASICA (2014), Manual de inspección sanitaria en establecimientos TIF para el sacrificio de aves, http://www.gob.mx/cms/uploads/attachment/file/118403/4.ManualdeInsp.SandeSacrificiodeAves.pdf

SIAP (2016), Capacidad instalada para sacrificio de especies pecuarias, https://www.gob.mx/cms/uploads/attachment/file/166037/Publicaci_n_actualizaci_n_rastros_2016.pdf

Sistema Producto Carne de Ave (2014), Plan Rector Visión 2014-2024, Imagen Editorial Yire, en http://sistemaproductoaves.org.mx/descargas/Plan_Rector_Carne_Ave.pdf

Swatland, H.J., 2010, "Meat Products and Consumption Culture in the West", Meat Science, 86, http://ssu.ac.ir/cms/fileadmin/user_upload/Mtahghighat/tfood/ARTICLES/meat/Meat_products_and_consumption_culture_in_the_East.pdf

Taylor, R. y D. Domina (2010), "Restoring Economic Health to Contract Poultry Production", http://www.dominalaw.com/documents/Restoring-Economic-Health-to-Contract-Poultry-Production.pdf

Teillant, A. y R. Laxminarayan (2015), "Economics of antibiotic use in US swine and poultry production", Choices 30(1), https://issuu.com/cddep/docs/choices_1.15

The Pew Charitable Trusts (2013), "The Business of Broilers", http://www.pewtrusts.org/~/media/legacy/uploadedfiles/peg/publications/report/businessofbroilersreportthepewcharitabletrustspdf.pdf

UNA (2016), Compendio de indicadores económicos del sector avícola.

USDA (1987), Meat and Poultry Inspection Manual, Food Safety Inspection Service

USDA (2014), Modernization of Poultry Slaughter Inspection: Final Rule, http://www.fsis.usda.gov/wps/wcm/connect/fb8c866a-a9b7-4b0d-81c9-f190c4a8d4d/2011-0012F.htm?MOD=AJPERES

Valdes, C., C. Hallahan y D. Harvey (2015), "Brazil's Broiler Industry: Increasing Efficiency and Trade", International Food and Agribusiness Management Review, 18(Special Issue), https://www.ifama.org/resources/Documents/v18ia/Valdes-Hallahan-Harvey.pdf

Varney, C. (2010), "The Capper-Volstead Act, Agricultural Cooperatives, and Antitrust Immunity", The Antitrust Source, https://www.americanbar.org/content/dam/aba/publishing/antitrust_source/Dec10_Varney12_21.authcheckdam.pdf

Villarreal, J., L. Flores y P. Castro (1998), "Programa de aparcería Tyson de México, S.A. de C.V.", Revista Mexicana de Agronegocios, III(3), http://www.redalyc.org/pdf/141/14100304.pdf

Vukina, T. (2001), "Vertical Integration and Contracting in the U.S. Poultry Sector", Journal of Food Distribution Research, Vol. 32(1), http://ageconsearch.umn.edu/bitstream/27819/1/32020029.pdf

Vukina, T., y P. Leegomonchai (2006), "Oligopsony Power, Asset Specificity, and Hold-Up: Evidence from the Broiler Industry", American Journal of Agricultural Economics 88, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.532.643&rep=rep1&type=pdf

Vukina, T. y X. Zheng (2015), "The Broiler Industry: Competition and Policy Challenges", Choices, 30(2), https://ag-econ.ncsu.edu/wp-content/uploads/2015/11/cmsarticle_424.pdf

Williamson, O.E. (1985), The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting, New York, Free Press.

Zhuang, R. y T. Moore (2015), "Factors Influencing U.S. Poultry Exports", International Food and Agribusiness Management Review, 18 (0), https://www.ifama.org/resources/Documents/v18ia/Zhuang-Moore.pdf

Annex. Results of the price analysis

In this section, we present the results of the econometric exercises carried out to determine the existence of relative price stationarity between the price series of feed inputs for chicken balanced feed (corn, sorghum and soybean paste), prices of balanced feed, as well as prices of whole chicken in the wholesale and retail markets. We also present the results of the analysis of stationarity of relative prices between different types of meat. Finally, we present the results of the mean difference analysis of consumer prices.

1. Stationarity tests between links in the chain

The analysis of stationarity between links makes it possible to determine if there is a constant price relationship, which means that changes in input costs translate into proportional changes in prices downstream. If stationarity is not verified, then some prices increase faster than others, which could be indicative of changes in the distribution of value added of the industry between the different links.

Monthly relative price series were obtained between the following products:

- balanced feed/yellow corn
- balanced feed/sorghum
- balanced feed/soybean paste
- balanced feed/whole chicken in distribution centres
- whole chicken in distribution centres/whole chicken for sale to final consumer

Results

Stationarity tests were performed on the indicated series, using Dickey-Fuller Augmented and Phillips-Perron tests.[90] The relative price series between balanced feed and yellow corn and sorghum were non-stationary to the order of integration of one. The relative price between balanced feed and soybean paste is stationary.

For balanced feed/yellow corn series, the test results are:[91]

[90] Specifications with constant and constant and trend were tested.

[91] Results are presented for the series in level and first differences.

Table A.1. Stationarity tests, relative price balance feed/yellow corn series, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-1.5589	-2.8852	0.5005
C & T	-2.0484	-3.4471	0.5688
Model	t-Statistic	1%	Prob
Constant	-9.1687	-3.4856	0
C & T	-9.1278	-4.0363	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-1.4906	-2.8852	0.5351
C & T	-2.0067	-3.4471	0.5916
Model	t-Statistic	1%	Prob
Constant	-9.6366	-3.4851	0
C & T	-9.5884	-4.0356	0

For balanced feed/sorghum series the test results are:

Table A.2. Stationarity tests, relative price balance feed/sorghum series, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-2.3224	-2.8852	0.1667
C & T	-2.4429	-3.4471	0.3559
Model	t-Statistic	1%	Prob
Constant	-10.5197	-3.4851	0
C & T	-10.4786	-4.0356	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-2.3983	-2.8852	0.1443
C & T	-2.6349	-3.4471	0.2659
Model	t-Statistic	1%	Prob
Constant	-10.5443	-3.4851	0
C & T	-10.5045	-4.0356	0

For balanced feed/soybean paste series, the test results are:

Table A.3. Stationarity tests, relative price balance feed/soybean paste series, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-3.8583	-2.8852	0.0031
C & T	-4.1565	-3.4471	0.0069
Model	t-Statistic	1%	Prob
Constant	-10.3085	-3.4856	0
C & T	-10.2898	-4.0363	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-3.8185	-2.8852	0.0036
C & T	-4.2243	-3.4471	0.0056
Model	t-Statistic	1%	Prob
Constant	-12.4557	-3.4851	0
C & T	-12.4272	-4.0356	0

For whole chicken in distribution centres/balanced feed, the test results are:

Table A.4. Stationarity tests, relative price whole chicken in distribution centres/balanced feed, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-4.9006	-2.8852	0.0001
C & T	-4.9984	-3.4471	0.0004
Model	t-Statistic	1%	Prob
Constant	-10.9229	-3.4856	0
C & T	-10.8778	-4.0363	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-4.8067	-2.8852	0.0001
C & T	-4.9098	-3.4471	0.0005
Model	t-Statistic	1%	Prob
Constant	-16.7935	-3.4851	0
C & T	-16.8816	-4.0356	0

For whole chicken in distribution centres/whole chicken for sale to final consumer series, the test results are:

Table A.5. Stationarity tests, relative price whole chicken in distribution centres/whole chicken for sale to final consumer series,January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-5.2337	-2.9012	0
C & T	-6.5296	-3.4717	0
Model	t-Statistic	1%	Prob
Constant	-9.147	-3.5242	0
C & T	-9.0803	-4.0906	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-5.2117	-2.9012	0
C & T	-6.4623	-3.4717	0
Model	t-Statistic	1%	Prob
Constant	-36.2749	-3.5229	0.0001
C & T	-38.0057	-4.0887	0.0001

2. Stationarity tests of relative prices between different types of meat

An analysis of stationarity of relative prices between types of meat, live and in carcass was carried out. The data available have an annual periodicity. The series analysed were:

- Cattle/chicken live
- Pork/chicken live
- Cattle/chicken carcass
- Pork/chicken carcass

Also, the relative price series was analysed:

- Chicken carcass/chicken live

Results

Stationarity tests were performed on the indicated series, using Dickey-Fuller Augmented and Phillips-Perron tests.[92] The relative price series between cattle/chicken, live and carcass, are non-stationary, indicating that the price of beef has increased over chicken meat. Regarding the prices of poultry carcass and live, the analysis concludes that the relative price is stationary, which is indicative of a constant profit margin in the long term.

For cattle/chicken live series, the test results are:

[92] Specifications with constant and constant and trend were tested.

Table A.6. Stationarity tests, relative price cattle/chicken live series, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-1.9061	-2.945842	0.3259
C & T	-3.0878	-3.540328	0.1244
Model	t-Statistic	1%	Prob
Constant	-6.4589	-3.6329	0
C & T	-6.4689	-4.2436	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-1.8197	-2.945842	0.3653
C & T	-3.1801	-3.540328	0.1044
Model	t-Statistic	1%	Prob
Constant	-7.0496	-3.6329	0
C & T	-6.782	-4.2436	0

For cattle/chicken carcass series, the test results are:

Table A.7. Stationarity tests, relative price cattle/chicken carcass series. January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-1.3927	-2.945842	0.575
C & T	-2.7328	-3.540328	0.2303
Model	t-Statistic	1%	Prob
Constant	-6.9388	-3.6329	0
C & T	-6.9864	-4.2436	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-1.1921	-2.945842	0.6672
C & T	-2.7934	-3.540328	0.2087
Model	t-Statistic	1%	Prob
Constant	-7	-3.6329	0
C & T	-7.005	-4.2436	0

For pork/chicken live series, the test results are:

Table A.8. Stationarity tests, relative price pork/chicken live series, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-3.1818	-2.945842	0.0294
C & T	-3.8755	-3.540328	0.0236
Model	t-Statistic	1%	Prob
Constant	-8.5863	-3.6329	0
C & T	-8.4916	-4.2436	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-3.0742	-2.945842	0.0376
C & T	-3.8419	-3.540328	0.0256
Model	t-Statistic	1%	Prob
Constant	-12.313	-3.6329	0
C & T	-18.5259	-4.2436	0

For pork/chicken carcass series, the test results are:

Table A.9. Stationarity tests, relative price pork/chicken carcass series, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-3.6615	-2.945842	0.0092
C & T	-4.0981	-3.540328	0.014
Model	t-Statistic	1%	Prob
Constant	-8.9116	-3.6329	0
C & T	-6.6731	-4.2627	0
Phillips-Perron Test			
Model (Level)	t-Statistic	5%	Prob
Constant	-3.6458	-2.945842	0.0095
C & T	-4.1182	-3.540328	0.0133
Model	t-Statistic	1%	Prob
Constant	-17.1449	-3.6329	0.0001
C & T	-17.3679	-4.2436	0

For chicken carcass/chicken live series, the test results are:

Table A.10. Stationarity tests, relative price chicken carcass/chicken live series, January 2007-March 2017

Dickey-Fuller Augmented Test			
Model	t-Statistic	5%	Prob
Constant	-5.1919	-2.945842	0.0001
C & T	-5.0886	-3.540328	0.0011
Model	t-Statistic	1%	Prob
Constant	-7.9714	-3.6394	0
C & T	-5.2876	-4.3561	0.0012
Phillips-Perron Test			
Model	t-Statistic	5%	Prob
Constant	-5.3336	-2.945842	0.0001
C & T	-5.2553	-3.540328	0.0007
Model	t-Statistic	1%	Prob
Constant	-13.2632	-3.6329	0
C & T	-12.9628	-4.2436	0

3. Mean difference analysis of consumer prices

A test of difference of means in the federative entities of Mexico was carried out. For this purpose, real prices of whole chicken sold to final consumers from January 2011 to March 2017 of INEGI were used, taking as a maximum price up to MXN 50 per kg.

The criteria that were used to make up the possible regions were: equality of means between entities and groups that are candidates to form regions, the contiguity of entities and the existence of a large company.

It was possible to determine 25 regions of the 32 entities. The only entities that formed the joint markets were: Region 4 with Guanajuato and San Luis Potosí, Region 6 with Hidalgo, Mexico and Michoacán, Region 7 Mexico City and Morelos, Region 8 Quintana Roo and Campeche and Region 17 Nuevo León and Coahuila. It is worth mentioning that only the data from the last two years of the 2015 and 2016 series were used for the conformation of Regions 6 and 17.

On the other hand, Sinaloa and Sonora are entities free of outbreaks of avian influenza and have a special regime that could allow them to export to the United States. This regime prevents the entry of chicken from other states.

The following is a summary of the descriptive statistics of the regions obtained by the mean difference test.

Table A.11. Descriptive statistics, whole chicken sold to final consumers per region, January 2011 to March 2017

Region	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
	Aguascalientes*	Jalisco*	Zacatecas	Guanajuato* San Luis Potosí	Querétaro*	Hidalgo México Michoacán	Mexico City Morelos	Quintana Roo Campeche Chiapas	Yucatán
Mean	31.43	34.68	36.54	32.63	33.57	31.67	32.74	29.1	30.63
Mediana	31.29	34.29	36.65	32.73	33.7	31.7	32.79	28.79	30.08
Max.	38.68	39.62	42.21	37.86	38.13	37.02	38.11	34.14	35.91
Min.	27.6	32.28	29.81	29.38	27.92	28.42	29.07	23.69	27.65
Standard Dev.	2.12	1.61	3.46	1.83	2.08	1.81	2.04	2.12	1.91
Región	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
	Tabasco	Veracruz*	Puebla	Oaxaca	Sonora	Sinaloa	Chihuahua	Nuevo León Coahuila	Tamaulipas
Mean	32.72	28.48	31.35	32.4	29.22	34.6	32.37	33.44	31.55
Mediana	32.99	28.35	31.52	32.14	28.93	34.64	32.27	33.94	31.5
Max.	38.47	34.53	36.19	38.16	33.32	38.12	38.22	37.31	37.08
Min.	26.23	25.49	27.63	27.67	27.25	28.83	28.59	29.73	27.53
Standard Dev.	2.82	1.95	1.76	2.19	1.4	1.83	2.3	2.05	2.38
Región	**19**		**20**	**21**	**22**	**23**	**24**	**25**	
	Baja California Sur		Baja California	Guerrero	Colima	Durango*	Nayarit	Tlaxcala	
Mean	32.1		33.36	29.39	36.9	32.74	32.19	28.22	
Mediana	30.94		33.37	29.72	36.92	33.59	32.23	27.87	
Max.	40.66		38.44	34.78	43.11	38.84	37.27	36.18	
Min.	26.15		29.62	24.43	32.95	24.34	29.09	23.61	
Standard Dev.	4.41		1.5	2.56	2.61	3.66	1.82	2.44	

*Large producing entities.

Source: INEGI.

Finally, a summary is presented with the results of the regions that could be grouped.

Table A.12. Summary of results of the mean difference test

	Variable	Obs.	Mean	Std. Dev.	Std. Dev. Error
Region 4	GTO	75	32.8429	1.8754	0.2165
	SNLUIS	75	32.41	1.9151	0.2211
	All	150	32.6265	1.9014	0.1553
	Method		**df**	**Value**	**Probability**
	Welch F-test*		(1, 147.935)	1.9566	0.164

	Variable	Obs.	Mean	Std. Dev.	Std. Dev. Error
Region 8	CAMP	75	28.8484	2.0212	0.2334
	QROO	75	29.1577	3.1591	0.3648
	CHIA	75	29.3017	2.3587	0.2724
	All	225	29.1026	2.5535	0.1702
	Method		**df**	**Value**	**Probability**
	Welch F-test*		(2, 143.889)	0.8367	0.4352

	Variable	Obs.	Mean	Std. Dev.	Std. Dev. Error
Region 6	HID	75	31.1473	1.9482	0.225
	MEX	75	32.0572	2.242	0.2589
	MICH	75	31.8092	1.979	0.2285
	All	225	31.6712	2.0872	0.1391
	Method		**df**	**Value**	**Probability**
	Welch F-test*		(2, 147.47)	3.9521	0.0213
	**Probability of (0.0813) using information of the last 2 years.				

	Variable	Obs.	Mean	Std. Dev.	Std. Dev. Error
Region 17	COA	75	33.8196	2.5784	0.2977
	NLEON	75	33.0497	2.0325	0.2347
	All	150	33.4347	2.3458	0.1915
	Method		**df**	**Value**	**Probability**
	Welch F-test*		(1, 140.349)	4.1239	0.0442
	** Probability of (0.093) using information of the last 2 years.				

	Variable	Obs.	Mean	Std. Dev.	Std. Dev. Error
Region 7	CDMX	75	32.6907	1.6336	0.1886
	MOR	75	32.7877	2.6402	0.3049
	All	150	32.7392	2.1885	0.1787
	Method		**df**	**Value**	**Probability**
	Welch F-test*		(1, 123.419)	0.0733	0.787

* Large producing states

Source: INEGI.

www.oecd.org/competition

