MEXICAN REPRESENTATIVE HOG FARMS 1995-2004 ECONOMIC OUTLOOK: PRELIMINARY STUDY

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The farm-level financial outlook for representative Mexican hog operations is projected in this report. The primary objective of this analysis is to determine the economic viability of Mexican hog farms by region and production system over the 1995-2004 planning horizon. The Agricultural and Food Policy Center's (AFPC) whole farm simulation model (FLIPSIM) and FAPRI's sector level price projections were used. The FLIPSIM model incorporates historical production, economic and financial data to project future economic and financial performance of representative agricultural firms over a given planning horizon (Richardson and Nixon, 1985). Data to simulate farming operations of six hog farms, located in two of the principal production regions in México, were obtained from the following sources:

- Projected macroeconomic variables from the Dirección General de Estrategia del Grupo Financiero Serfin (GFS).[1]
- Farm-level information from two research works (Méndez and Lara, 1996; Morán and Ortíz, 1996).
- Projected prices for pork and input variables from the Food and Agricultural Policy Research Institute (FAPRI) January 1998 Baseline.

This report is organized into the following four sections:

- Summarizes the role and the status of the hog industry in México and the major hog producing regions.

[1] S. Salcedo-Baca. Personal Communication.

- Describes the origin of the information and the farms included in the analysis.
- Indicates the key assumptions, price projections for the farm-level analysis and the economic variables.
- Presents the results of the simulation analyses and the preliminary conclusions.

Two appendices constitute the final section of the report. Appendix 1 includes the technical characteristics of each farm. Appendix 2 presents the financial characteristics of each farm.

1. The Mexican Hog Industry

1.1 Mexican hog and pork production and consumption

Hog production is one of the most important agricultural activities in México. In 1997 this activity generated 939,000 MT of pork, which represented about 24 percent of the country's meat production (SAGAR, 1997). By comparison, US pork production was 17.3 million pounds in 1997. The value of Mexico's pork production was MX$17 billion (US$2.1 billion), which was equivalent to 19 percent of the country's total livestock production value. According to CANACINTRA (National Processing Industry Chamber, 1997), in 1995 the pork industry generated 56,000 direct and 280,000 indirect jobs.

Per-capita pork consumption in 1995 was 10.6 kg. (23 lbs.), down from 20.8 kg. (45.9 lbs.) in 1983 (Ramirez and Sagarnaga, 1998). Over the 1960-1970 period, chicken consumption increased relative to pork consumption. Over the same period, beef consumption remained relatively constant (Sagarnaga, Salas, and Ochoa, 1998).

Per capita pork consumption is ranked third after beef and chicken (Ramírez and Sagarnaga, 1998). Pork consumption represented 22 percent of total meat consumption, which was 47 kg. (103 lbs.) in 1995. In 1995, US consumers ate 30.5 kg. (63.3 lbs.) of pork per capita and 75 kg. (166.6 lbs.) of total meat (carcass weight equivalent) (USDA/ERS).

1.2. Current situation in Mexican hog production

Hog production in México has been characterized by market cycles, as in other countries. Pork production peaked in 1983, although historically high production has been recorded throughout the 1970s and early 1980s. Thereafter, a series of changes triggered a

crisis in the industry resulting a severe contraction in the hog inventory, slaughter, and pork production. The major factors contributing to this crisis included a reduction in the price subsidy for sorghum, the beginning of more open trade, and decreasing real producer pork prices. Because of differences in production systems across the country, some regions were more severely impacted than others by the crisis.

Early in the 1990s, hog production in Mexico faced a series of adverse factors. The major adverse conditions affecting the industry were the signing of NAFTA, the peso devaluation, rising interest rates, and near record international feed grain prices in 1995 and 1996. Consequently, hog production has not been able to recover from the industry contraction in the previous decade. Mexican hog production, which was nearly 1.43 million MT in 1983, contracted to 879,000 MT by 1997. This sector has also experienced severe producer attrition, as indicated by a 40 percent reduction in membership in hog producers' interest groups (Sagarnaga and Flores, 1997). There are clear signs of a trend toward vertical integration of the industry as in the US. Under these situations, economic and regional concentration of the hog production sector in Mexico has been observed.

In the last couple of years, however, hog production in Mexico has shown some signs of recovery. In this period, hog inventory, slaughter, and production have increased slightly. Structural changes have been noted among farms primarily in the Northeast and the Southwest. These regions not only have increased their inventory and production, but also have registered higher levels of performance in terms of pigs per sow and feed conversion rates. The technical parameters of those farms have shown efficiency levels similar to some of the highly productive US farms (Morán and Ortíz, 1996).

In spite of the slight recovery observed in the hog production, this sector has not been able to meet the national demand for pork products. The result of which has been increasing imports of pork products. Pork imports were stimulated by NAFTA, reaching 93,000 MT in 1994; one year later they suffered a severe contraction because of the peso devaluation. However, imports have been continuously increasing since then. In 1997 the imports of pork products reached 47,876 MT, 60 percent more than the previous year (USDA/FAS, 1998). In 1999 Mexico imported 100 percent of its imported pork from the United States.

Domestic and imported pork products compete directly with other meats. Imported poultry products, such as chicken and turkey pieces and meals, are used by the meat industry as substitutes for pork products. The absence and noncompliance of norms and standards of quality and content in the meat processing industry allow the use of such products as substitutes for pork. It is estimated that over the period 1994-1996, imported chicken and turkey meals and pieces displaced the equivalent of 28 to 57 percent of national pork production and consumption (Sagarnaga and Flores, 1997).

Mexican exports of pork products are minimal, although they have risen from 2,400 MT in 1994 to 22,700 MT in 1997. In 1997, 72 and 24 percent of the exports of the hog sector went to US and Japanese markets, respectively. Exports of pork products were equivalent to 47 percent of the pork imports in the same year (USDA/FAS, 1998).

The Mexican hog/pork sector continues to show a negative trade balance. Since the early 1980s, Mexico has been a net importer of pork. However, as imports outpaced exports the trade balance worsened. The deficit increased by 66 percent, which represented expenses of US$30 and 50 million in 1996 and 1997, respectively (SAGAR, 1998).

According to the Government of Mexico's National Plan of Development, over the next ten years, the Mexican population and per-capita income will grow 2 and 5 percent per year, respectively, over the next decade.[2]. Income and population growth suggest that the demand for pork should increase. Mexico will need a dynamic and productive sector if it is to have the ability and capacity to compete in domestic and foreign.

1.3. Principal hog producing regions in México

The hog production systems of Mexico are heterogeneous and regional; eight States generate 76 percent of the nation's hog production (SAGAR, 1998). The main hog-producing region, in terms of volume, is the Central Pacific region. This region includes the States of Jalisco, Guanajuato and Michoacan and produces 37 percent of the nation's pork. The second most important hog-producing region is the Northwest, which includes the States of Sonora and Sinaloa, which produces 20 percent of the nation's pork. The Central Gulf region, including the States of Veracruz and Puebla, accounts for 12 percent of the nation's pork production. The Southeast region, including only the State of Yucatan, generates 7 percent of Mexican pork. The remaining 24 percent of hog production is generated in other States.

The hog producing regions utilize a wide array of production systems. The Central Pacific region has traditionally produced hogs by utilizing a higher family involvement in management combined with intermediate to advanced technology. Its producers use specialized facilities, commercial feeds and hired labor. A small proportion of the farms use the "multiple-site" production scheme and hire technical advice from genetics and nutrition

[2] Mexico has a population of about 100 million with a per-capita income level of US$4,200 (Presidencia de la Republica, 1995).

specialists. The proximity to México City allows this region to be one of the capital's most important suppliers. Additionally, this region is an important sorghum production area. Therefore product both marketing and feed costs are relatively lower (Méndez and Lara, 1996).

The Northwest region is characterized by hog operations that are part of consortiums or groups of individuals, which utilize high levels of investment and technology. These units commonly use specialized facilities with fully automated operations. The farms own feedmills to formulate rations tailored to their specific nutritional requirements. Frequently the hog farms work under the "multiple-site" production system, which facilitates sanitary management and reduces disease incidence. Market contracting is common, and in many instances, the producers are partners in the slaughter and/or meat processing industries. Most of the production generated in this region goes to other Mexican States. Sonoran involvement in hog production is relatively recent. Since it is the only State considered "disease-free," it has potential as an exporter of pork products (Morán and Ortíz, 1996).

The Southeast region is characterized by its large hog operations. The hog farms in this region have a high level of investment and technology use. This region is located far away from the principal Mexican pork consuming regions and it produces little sorghum. Therefore it is heavily dependent on distant markets for sales, as well as for the acquisition of imported and domestic feed.

The Central Gulf region produces large amounts of pork. However, the region is not a net exporter because most of its pork production is consumed locally. The region's hog production is characterized by small family "backyard" operations. This hog production system is characterized by low inputs, low usage of technology and management, and by its

rudimentary facilities. The hogs are fed minimum amounts of commercial feeds, which are complemented with industrial and agricultural by-products, and table scraps. In this region the low level of herd health management results in higher disease rates, mainly swine fever or swine cholera.

2. Methodology

2.1. Data development and simulation process

The sensitivity of the Mexican swine sector to the domestic and foreign economic environment makes the analysis of future financial viability of hog production by the use of traditional methods difficult. The application of simulation techniques allows economic and financial analyses under such conditions. With these tools, it is possible to perform ex-ante assessment of the economic and financial performance of hog production operations, under different scenarios with relative ease.

The whole farm simulation model, FLIPSIM, is used in this analysis to model the financial performance of hog operations. FLIPSIM is an excellent tool to analyze the economics of farm operations, where indicators of future economic performance are needed beforehand to assess the adoption of a specific technology or applying government policy changes to the farm-level agriculture sector in a country. The stochastic capabilities of FLIPSIM allow the incorporation of risk factors, such as price and productivity into the analysis.

The representative farm panel process has been successfully utilized in analyzing the farm-level impacts of agriculture policies (Richardson et al., 2000). Simulation techniques used in conjunction with the panel farm process have proven to be widely successful in farm-level analyses. Simulation modeling techniques using representative farms have been successfully applied in the study of the Mexican livestock and dairy sectors (Ochoa et al., 1998 a, b). Results have provided producers, industry leaders, and policy makers the necessary information to establish improved decision-making processes to benefit the Mexican dairy industry, its commercial partners, and consumers.

However, the data collection process for this study significantly differed from the method traditionally used by the Agricultural and Food Policy Center (AFPC). For this research, the hog production information was collected during 1995 from individual farms through individual producer surveys and interviews (Méndez and Lara, 1996; Morán and Ortíz, 1996). Therefore, this research could be considered a case study of the industry's production sector.

2.3. Description of the hog farms in this study

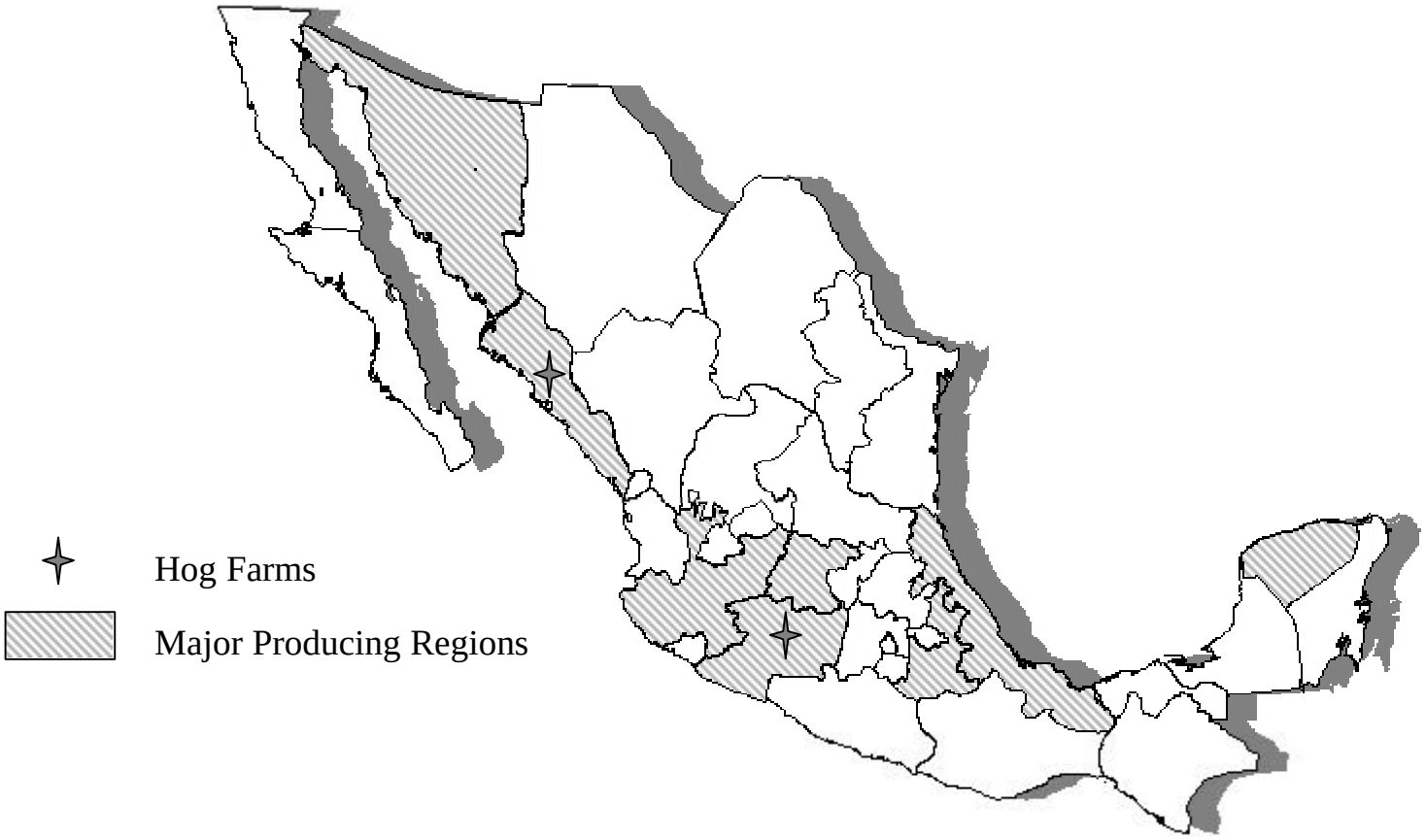
This work includes data for six Mexican hog farms. Three of these farms are located in the State of Sinaloa (Northwest region) and three are located in the State of Michoacan (Central Pacific region). Selection of these regions allows the analysis of two contrasting major hog producing regions in Mexico. Multiple farms allow analysis of hog production by farm size, as well (Figure 1).

In this study the farms were classified as moderate, intermediate and large size, taking into consideration only the number of sows. Therefore, the 260- and 305-sow farms in Michoacan and Sinaloa (MICH260 and SIN305) are considered of moderate size. The 600- and 850-sow farms in Michoacan and Sinaloa (MICH600 and SIN850) were established as intermediate size. Finally, the 950- and 1,200-sow farms in Michoacan and Sinaloa (MICH950 and SIN1200) were considered large size farms. These farms are referred to below by size and by name. Appendix 1 summarizes the main characteristics of each farm.

All of the farms hire labor in addition to family and buy commercial feeds, with the exception of SIN1200, which owns a feedmill to formulate specific rations. All the farms sell 220-242 lb. pigs to be slaughtered, again with the exception of SIN1200. This farm sells 20 percent of the barrows for slaughter and 80 percent are retained and developed as boars to

be sold as breeding stock. The breeding boars typically carry about a 30 percent premium over the barrow and gilt prices. This breeding stock business contributes to a significant increase in revenues compared to the other farms.

Figure 1. Principal hog-producing regions in México and location of the case-study hog farms



3. Assumptions and Procedures

3.1. Key assumptions

- All of the farms were operating at 100 percent capacity utilization at the time of data collection. Significant expansion would require additional facility construction. No herd liquidation was assumed during the down turn of the market cycles.
- The number of sows was considered constant for all farms over the 10 year planning horizon.
- Technical parameters such as litter size, sale weight, and feed conversion rate were held constant.
- Expenses included the producer's salary**.** According to producers' information, a basis salary equivalent to a professional technician salary was appropriate. The producer's annual salary charged was MX$8,000 (US$ 875) in Michoacan and MX$10,000 (US$ 1,094) in Sinaloa, basis 1998. The salary was increased by 30 and 50 percent for the intermediate and large size farms, respectively, over the 10-year planning horizon.
- Managerial costs were charged for all farms. These were assumed at a base rate ranging from 3 to 7 percent of Gross Receipts. Managerial costs represent the amount of money either paid to a professional manager on a contractual basis or the amount of money extracted from the operation by the owners as dividends[3].
- Annual interest rates were based on the 28-day CETES (Treasury Bond) rate.

[3] Producers's salary was included as compensation to the owner for his/her work at the farm. This salary is equivalent to that of a qualified technician. Managerial costs were included to account for family living expenses in the case of the smaller farms or to account for the salary of a professional manager in the case of the larger, more business-oriented farms.

- All of the farms were charged short-term operating loans to finance 65 percent of their operating costs.
- Long- and intermediate-debt reflected a 20 percent debt-to-asset ratio on the moderate size farms. Long-term debt was increased to 30 percent for the intermediate size farms, while the intermediate-term debt-to-asset ratio was held at 20 percent. Forty and 30 percent long-term and intermediate-term debt-to-asset ratios, respectively were assumed for the large farms.
- No off-farm income, such as family employment, was included in the analyses.
- No hog subsidies were paid by the government.[4]
- No federal tax was charged in this study. This was a simplifying assumption recognizing that the producers can employ many tax strategies.

3.2. Price and policy projections

This study includes two analyses, a historic and a prospective. The historic study shows the economic performance of the farms included in this study over the 1995-1998 period. The prospective, or forward looking study, analyses the economic performance of the farms over the 1999-2004 period. In the historic study, prices for pork and sorghum, exchange rates and interest rates utilized were actual observed prices. For the prospective analysis, projections from the Food and Agricultural Research Institute (FAPRI) were utilized. The US projected prices were converted into Mexican pesos using the exchange rate projections (MX pesos / US dollar). Those values were adjusted, using the Mexican inflation rate

[4] The Government of Mexico does not offer direct support for hog production. Occasionally, it has paid cash support for the hog slaughtered in federally inspected slaughter houses (*Tipo Inspección Federal - TIF).* Usually the middle-man received this cash support. However, producers who directly market their hogs have been entitled to this support payment.

projections and adding import fees. Consequently, trends may diverge somewhat from the projections for the respective commodities in US currency. Table 1 contains projected prices and macroeconomic variables from the following sources:

- Price projections for sorghum and pork were developed from FAPRI's projections. Projections were adjusted by the exchange rate, hauling costs, import fees, and import taxes to reflect moving the product to the Mexican consumption centers.

Table 1. Price and macroeconomic projections for Mexico used in this study.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sorghum Price										
MX$/ton	816	996	1,049	1,168	1,278	1,485	1,593	1,700	1,797	1,898
Pork Price										
Gilt and Barrows MX$/lb.	2.95	4.47	5.50	4.78	5.17	6.27	6.96	6.84	6.74	7.67
Culled sows MX$/lb.	2.11	3.19	3.92	3.41	3.69	4.47	4.96	4.88	4.81	5.47
Exchange Rate										
MX$/US$	6.52	7.63	8.12	9.14	10.32	12.00	12.86	13.46	14.10	14.67
PCI	156.9	183.5	222.0	258.1	293.1	327.4	357.4	387.3	417.3	444.8
Inflation Rate (%)	52.0	43.1	21.0	16.3	13.6	11.7	9.2	8.4	7.7	6.6
Interest Rate										
CETES (%)	48.65	27.23	23.53	24.51	20.29	19.23	16.13	14.18	13.19	12.33
Long-term (%) 1/	50.65	29.23	25.53	26.51	22.29	21.23	18.13	16.18	15.19	14.33
Intermediate-term (%)2/	52.65	31.23	27.53	28.51	24.29	23.23	20.13	18.18	17.19	16.33
Savings (%) 3/	14.6	8.169	7.059	7.353	6.087	5.769	4.839	4.254	3.957	3.699

SOURCE: FAPRI, Direccion General de Estrategia, GFS.
1/ CETES + 2.0
2/ CETES + 4.0
3/ CETES * 0.3

- Projected prices of commercial feed and feedstuffs, other than grain, were based on the 1995 prices reported by the producers. Those prices were adjusted by changes in the estimated observed growth index of the annual sorghum price. Other fixed and variable costs were inflated with projected production cost inflation rates.

- Projected exchange, interest and inflation rates were obtained from the Dirección General de Estrategia del Grupo Financiero Serfin (GFS).
- The prices for culled sows and boars reflect a discount to barrows and gilts prices. The price for a culled sow represents 70 percent of the barrow and gilt price, and the price for boars represent 130 percent of the barrow and gilt price (Méndez and Lara, 1996; Morán and Ortíz, 1996).
- Projections of interest rates are based on the 28-day CETES. Two points were added for long-term loans, four points for intermediate-term loans, and a third of CETES was considered for savings earnings (Ochoa et al., 1998).

3.3. Definitions of performance measures

- **Annual percentage change in real net worth, 1995-2004.** The annualized percentage change in the operator's net worth from January 1, 1995 through December 31, 2004, after adjusting for inflation. This value reflects the real annualized increase or decrease in net worth or equity for the farm over the planning horizon including changes in real estate values.
- **NIA for total real net worth, 1995-2004**. Net income adjustment (NIA) is the annual increase or decrease in net cash farm income necessary to cause the annualized percentage change in real net worth, including land inflation, to equal zero over the planning horizon. If the change in net worth is negative, the NIA is the annual increase in net income necessary to prevent a loss in total real net worth. NIA's are expressed both as total dollars per year and as a percent of average annual cash receipts.
- **Costs to receipts ratio, 1995-2004.** The ratio of total cash expenses to total receipts (from the sales of animals). Cash expenses include interest costs, fixed cash costs, and

variable costs but exclude principal payments, depreciation, income taxes, and family living expenses.

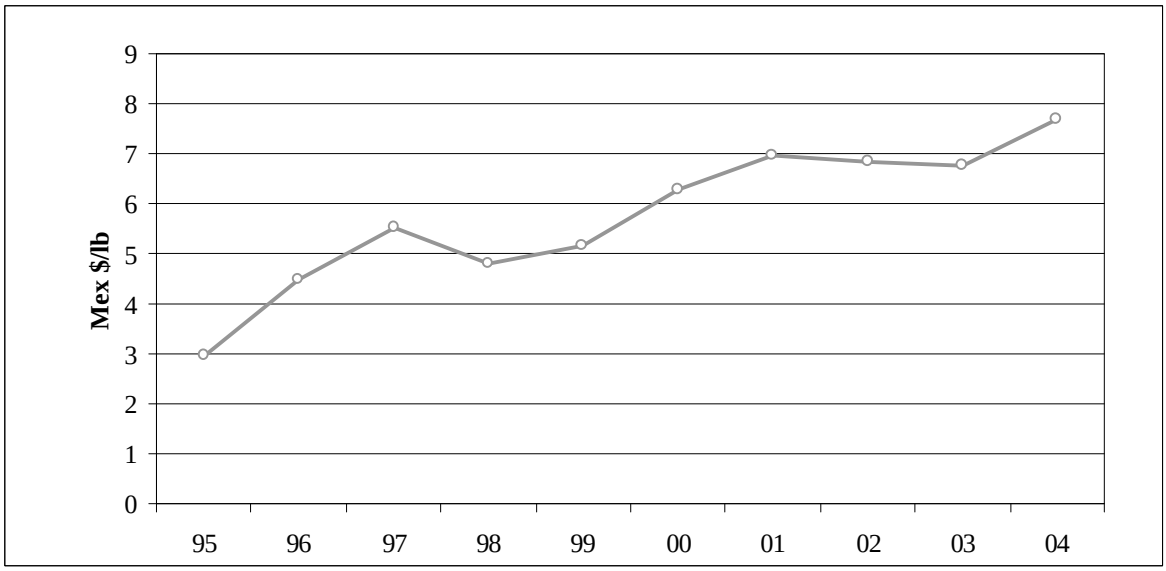
- **Total cash receipts.** Total receipts are cash receipts from market sales and other farm-related income.
- **Total cash expenses.** Total expenses are cash expenses for input purchases related to the farm operation. Cash expenses exclude depreciation, principal payments, income taxes and machinery replacement costs.
- **Net cash farm income.** Net cash farm income equals total cash receipts minus all cash expenses. Net cash farm income is used to pay family living expenses, principal payments, income taxes, and machinery replacement costs.
- **Ending cash reserves.** This is the cash on hand at the end of the year. Ending cash equals beginning cash reserves plus net cash farm income and interest earned on cash reserves less principal payments, income taxes, family living withdrawals, and machinery replacement costs.
- **Nominal net worth.** The total net worth or equity at the end of each year in the planning horizon equals total assets including land and livestock minus total debt from all sources. This value of net worth is not adjusted for inflation.
- **Real net worth.** The nominal net worth adjusted for inflation equals real net worth. It represents the equity of the farm after inflation for each year in the planning horizon.
- **Return/asset.** The rate of return based on the total value of assets. This index reflects the economic efficiency of the operation.
- **Return/equity.** The rate of return based on the total equity or net worth of the farm. This index considers the financial liabilities of the operation.

- **Net present value.** This represents the present value of the change in the net worth of the farm and annual earnings over the 10-year planning horizon.

4. Mexican Hog Farm's Performance

The research results of the financial performance of the hog farms are summarized in Table 2., Figures 3-11 and Tables A.2.1-A.2.4 of Appendix 2. The projected nominal domestic pork price over the 1999-2004 period is depicted in Figure 2. Projections of domestic pork price indicate a cyclical pattern about an increasing trend. The planning horizon including the historical and the projected period (1995-2004) includes two complete price cycles. In the first cycle, the pork price peaked in 1997 and bottomed out in 1998. In the second cycle, the price for pork reaches a peak in 2001, then declines until 2003. The increase in the price for pork observed in 2004 indicates the beginning of another cycle[5].

Figure 2. Projected nominal domestic pork producer price in Mexico, 1995-2004.



[5] In 1997, the international hog price decreased 3 percent (from US$1,170 to 1,140 per metric ton). The exchange rate grew 8 percent (from 7.55 to 8.12 pesos per dollar). The domestic price for hogs rose 23 percent (from MX$ 9.84 to 12.11 per kg.)

All six hog farms experience total annual cash receipts that closely follow the pattern of the hog price cycle (Figure 3-5). Substantial increases in total cash receipts are observed in 1997, 2001 and 2004. In 1998, cash receipts decreased sharply, as they did in the US. The same occurs in 2003. Because herd size and technology usage were considered constant over the study period, total expenses grew due to increases in feed costs and as other input costs increase due to inflation.

The first year of the period of study, 1995, was a difficult one for Mexican hog producers. Five of the six farms (the exception was SIN1200) had a negative cash balances with cash expenses exceeding cash income. As hog prices increased sharply in 1996 and 1997, and expenses showed little change, net income was the highest over the historical part of the study. In 2001 and 2004, net income was similar to the relatively high levels observed in 1997 (Figures 3-5).

Over the study period, the average costs-to-receipts ratio was less than 100 percent for all the farms. On average, the farms were able to cover their production costs and have surpluses to cover family living, capital replacement and principal expenses. In this respect, SIN305 was the most efficient of the moderate size farms, MICH600 was the most efficient of the intermediate size farms, and SIN1200 was the most efficient of the large size farms with a cost-to-receipts ratio of 62 percent. The ranking of the farms in terms of efficiency was consistent with respect to rankings based on other variables such as return-to-equity ratio, net income adjustment (NIA) and liabilities-to-assets ratio (Table 2).

Figure 3. Projected cash receipts, cash expenses and net cash farm income Mexican moderate size hog farms, 1995-2004

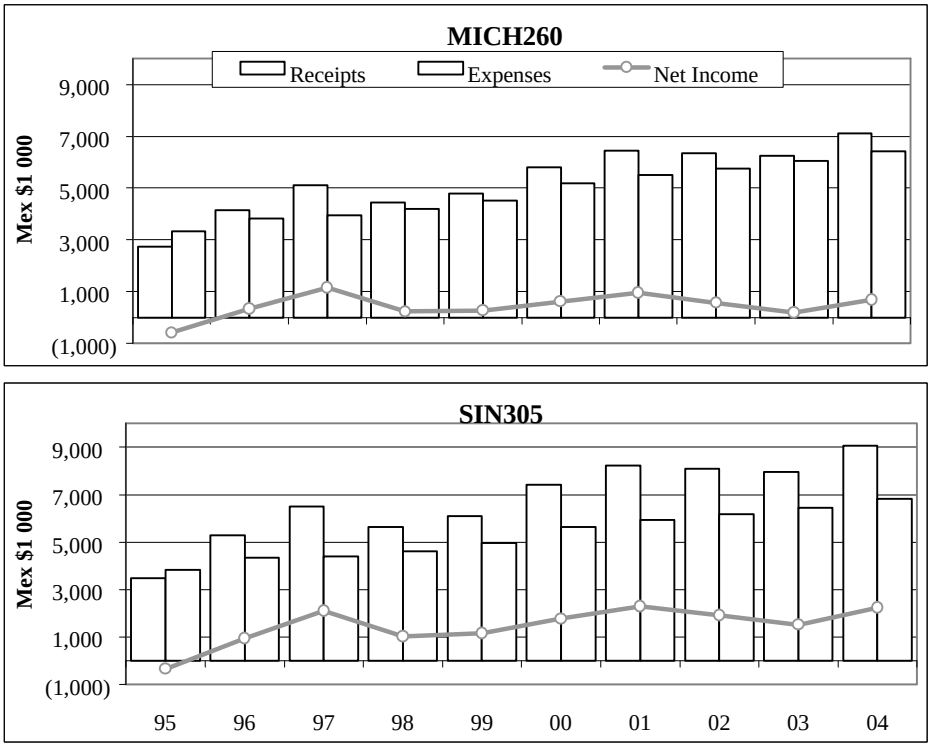


Figure 4. Projected cash receipts, cash expenses and net cash farm income Mexican intermediate size hog farms, 1995-2004

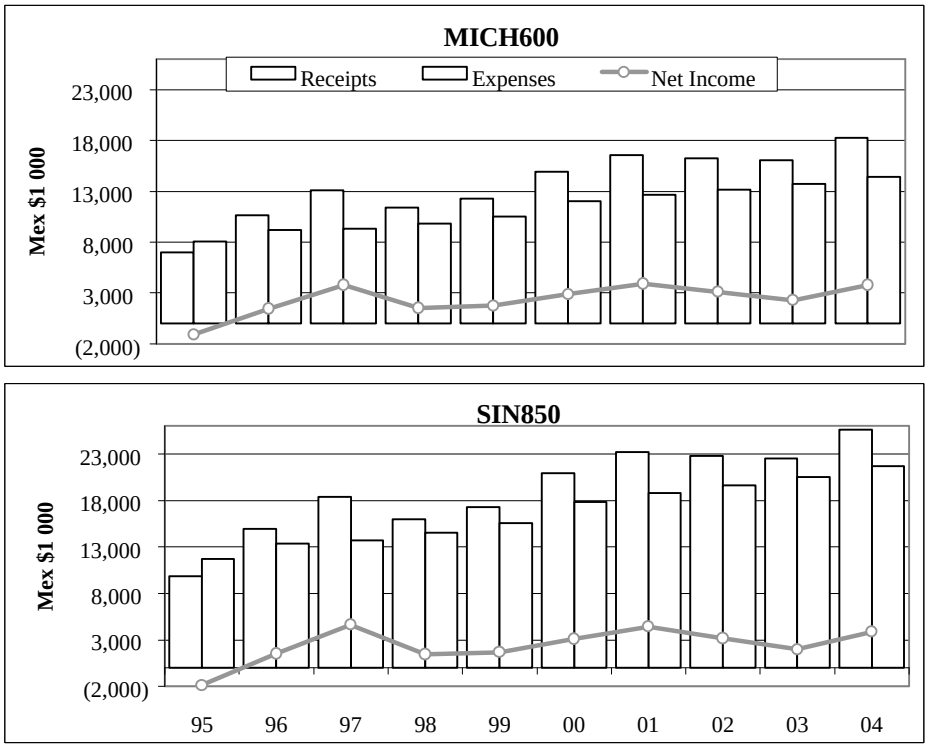
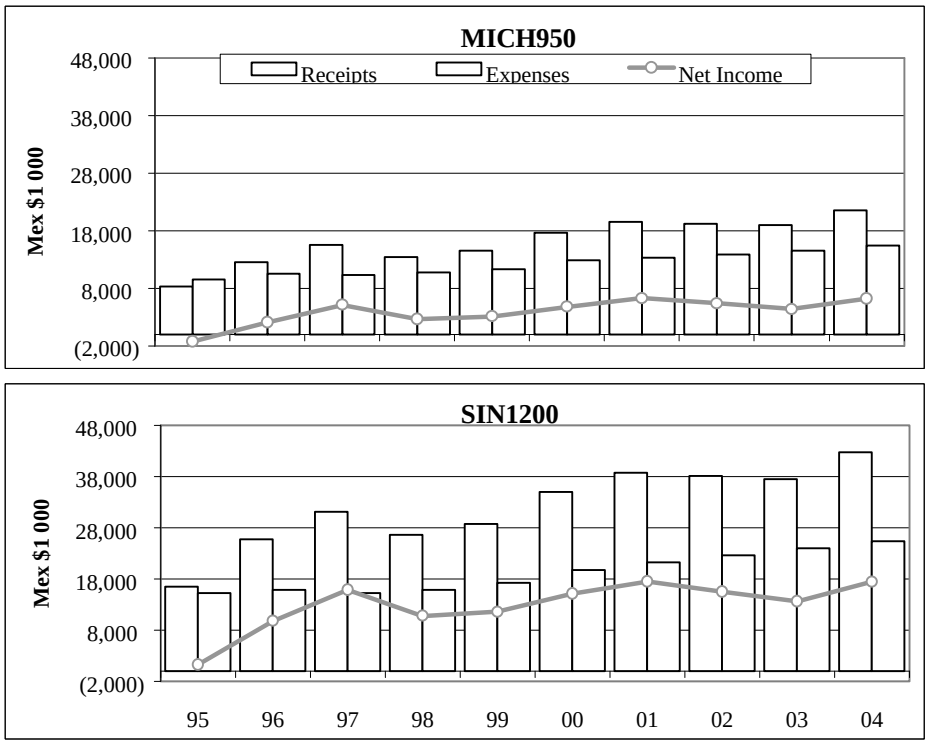


Figure 5. Projected cash receipts, cash expenses and net cash farm income Mexican large size hog farms, 1995-2004



All farms showed a positive ending cash balance in 2004 (Table 2). The income generated during 1995-1996 was positive, but not enough to cover managerial costs and debt obligations. Consequently, the farms had negative ending cash balances, early in the planning horizon, with the exceptions of SIN305 and SIN1200 (Figures 6, 7 and 8). The 305-sow Sinaloa farm generated a negative cash balance only during 1996. The large Sinaloa farm showed only the positive cash balances throughout the planning horizon. After 1997, the rising hog price allowed the farms to generate positive cash balances. Since the farms were not allowed to expand and the extraction of capital was limited, all the farms showed growing cash balance over the planning horizon, with exception of MICH260.

The average real net worth remained positive for all the farms over the planning horizon (Table 2). However, some year-to-year contractions in real net worth were observed. Those contractions indicate real net worth losses relative to the previous year. In 1995, decreases in real net worth ranged from 18 to 38 percent, with the exception of SIN1200, which showed continuous growth in real net worth over the study period due to its breeding program. The reduction in real net worth was caused, for the most part, by rising interest rates during the Mexican financial crisis. Reductions in net worth were observed in two other years 1998 and 2003, coinciding with cyclical downturns in hog prices. MICH260 experienced a reduction in real net worth in 1999 and 2002.

Average return to assets was positive for all the farms over the ten-year period. But, return on assets grew at a slower rate in the out-years (Figures 9, 10 and 11). The average return on assets was similar for the six farms, ranging from 37 to 39 percent (Table 2) over the 1995-2004 period. In 2003 this ratio was approximately one-third of the ratio observed in 1998.

Table 2. Simulated financial parameters of the Mexican hog farms, 1995-2004.

	MICH260	MICH600	MICH950	SIN305	SIN850	SIN1200
Expenses/Receipts Ratio (%)						
Average 1995-2004	93	85	79	80	89	62
Real Net Worth (MX$1 000)						
Average 1995-2004	2,086	7,421	11,298	4,032	7,689	38,223
Final Cash Balance (MX$1 000)						
Average 1995-2004	190	65360	11,518	4,235	5,036	55,044
Return on Assets (%)						
Average 1995-2004	37	38	37	38	39	37
Return on Equity (%)						
Average 1995-2004	20	27	29	28	22	34
Net Present Value (NPV) (MX$1 000)						
Average 1995-2004	5,593	22,790	36,308	13,107	23,136	120,287
NIA Net Worth (MX$1 000)						
Average 1995-2004	(102)	(961)	(1,766)	(590)	(806)	(8,219)
NIA Net Worth (% Income)						
Average 1995-2004	1.92	7.04	10.95	8.7	4.21	25.59
Liabilities/Assets Ratio (%)						
Average 1995-2004	14	11	13	8	13	6

* Annual information is provided in Tables A.2.1-A.2.4.

The average return to equity ratio ranged from 20 to 34 percent for all of the farms over the 1995-2004 period (Table 2). Annual returns to equity were negative in 1995 for all but one of the farms (SIN1200). For the remainder of the period this ratio was positive, although it indicated much volatility. A higher return to equity was earned in Sinaloa than in Michoacan. In both states the highest return on equity was observed for the large size farms.

Returns on assets and equity indicated a decreasing trend throughout the study period. However, that trend should not be considered as an indicator of reductions in the hog farms profitability. As mentioned previously, the assumptions of this analysis allowed cash balance to accumulate. Assets and equity grew because of increasing cash balances and the values of other assets. Returns did not grow faster than assets leading to a smaller calculated return.

Figure 6. Projected real net worth and cash balance Mexican moderate size hog farms, 1995-2004

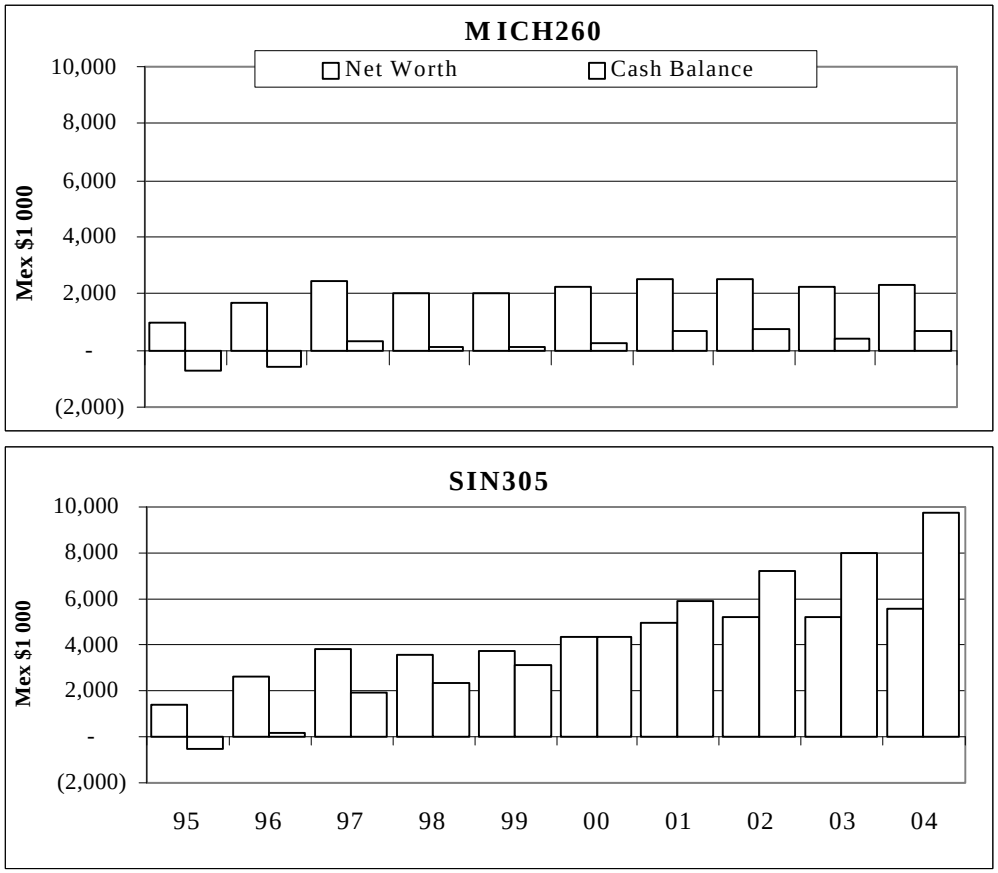


Figure 7. Projected real net worth and cash balance Mexican intermediate size hog farms, 1995-2004

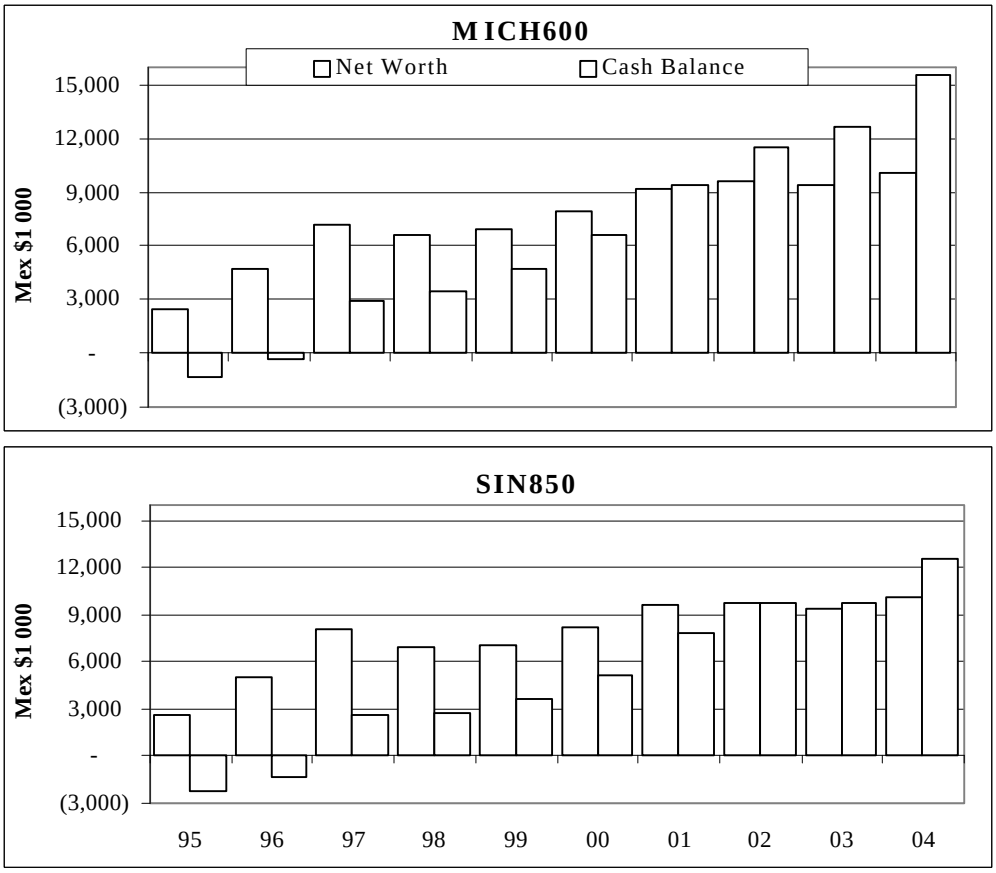


Figure 8. Projected real net worth and cash balance
Mexican large size hog farms, 1995-2004

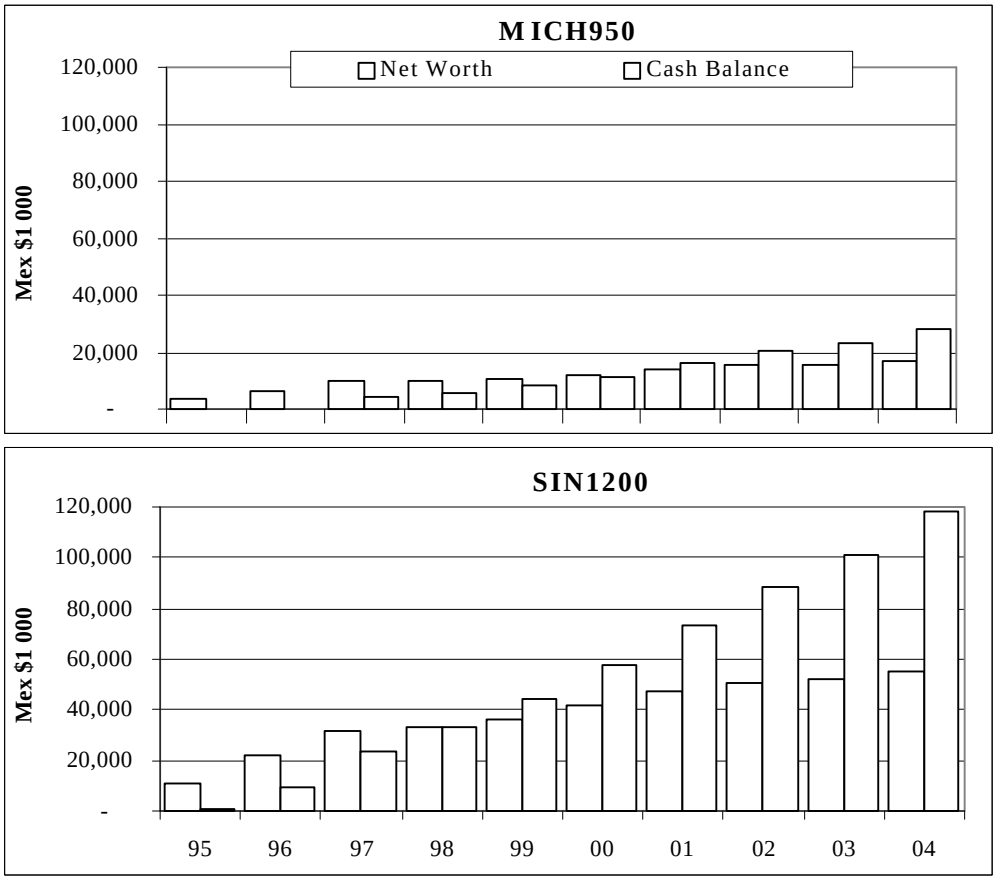


Figure 9. Projected return/assets and return/equity ratios Mexican moderate size hog farms, 1995-2004

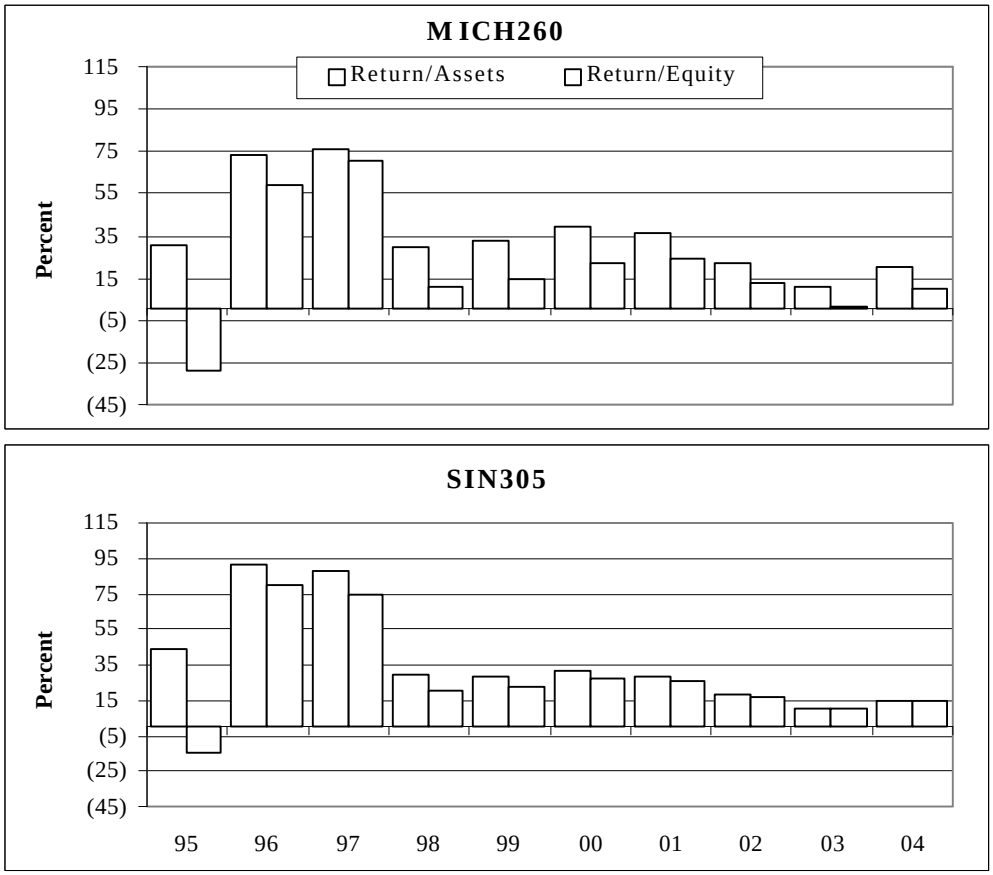


Figure 10. Projected return/assets and return/equity ratios Mexican intermediate size hog farms, 1995-2004

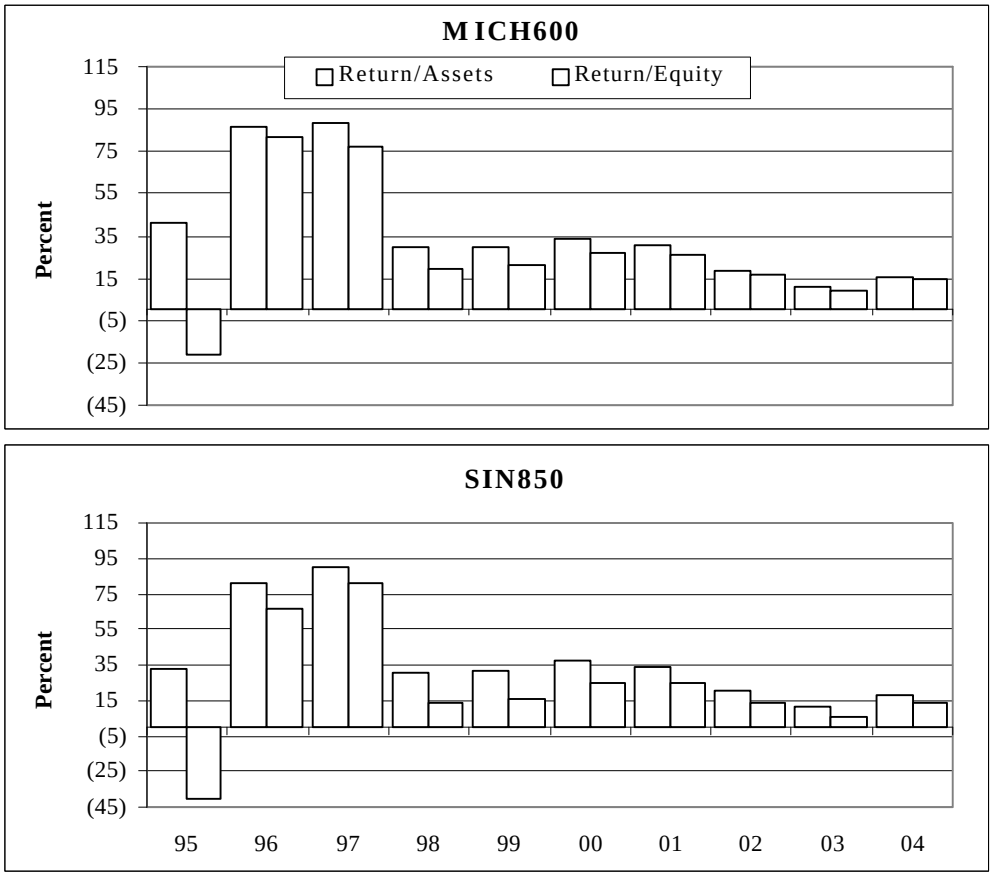
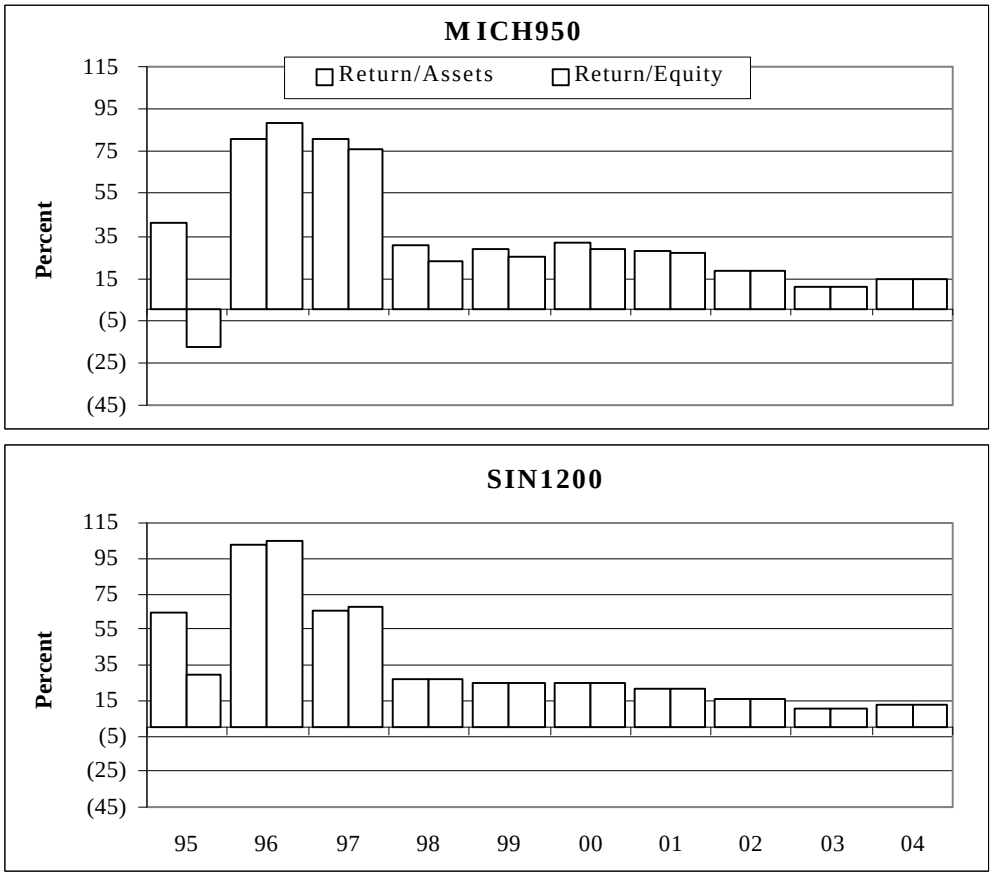


Figure 11. Projected return/assets and return/equity ratios Mexican large size hog farms, 1995-2004



All of the farms showed a positive net present value (NPV) over the 1995-2004 period (Table 2). The average net income adjustment (NIA) as a percentage of total receipts ranged from minus 2 to minus 9 percent for the moderate size farms and from minus 4 to minus 7 percent for the intermediate size farms. In the large farms the NIAs ranged from minus 11 to minus 26 percent (Table 2). This means that total receipts could decline by that amount, but yet the farm would be able to maintain real net worth. SIN1200 was able to withstand the highest reduction in total receipts. It should be noted that this farm sells 80 percent of its barrows as breeding stock with a 30 percent price premium. The farm in the weakest condition was MICH260, where only a 2 percent reduction in total receipts would result in a reduction in real net worth.

The average total debt to asset ratio ranged from 11 to 14 percent for the moderate size farms, from 8 to 13 for the intermediate size farms, and from 6 to 13 percent for the large size farms (Table 2). Total debt peaked for all the farms at 24 (SIN1200) and 56 percent (SIN850) in 1995, declining thereafter (Table A2.4). In 1997, when the farms were able to cover operation costs, this ratio declined considerably, which allowed for further equity growth. In Michoacan, the intermediate size farm has the lowest total debt to asset ratio for the period of study. In Sinaloa, the large farm has the lowest debt to asset ratio. The average financial cost to total cash cost indicates that the financial cost represented from 9 to 17 percent of the total cash expenses for the hog farms (Table A2.4).

Figure 12. Projected debt to assets and interest cost to total costs ratio Mexican moderate size hog farms, 1995-2004

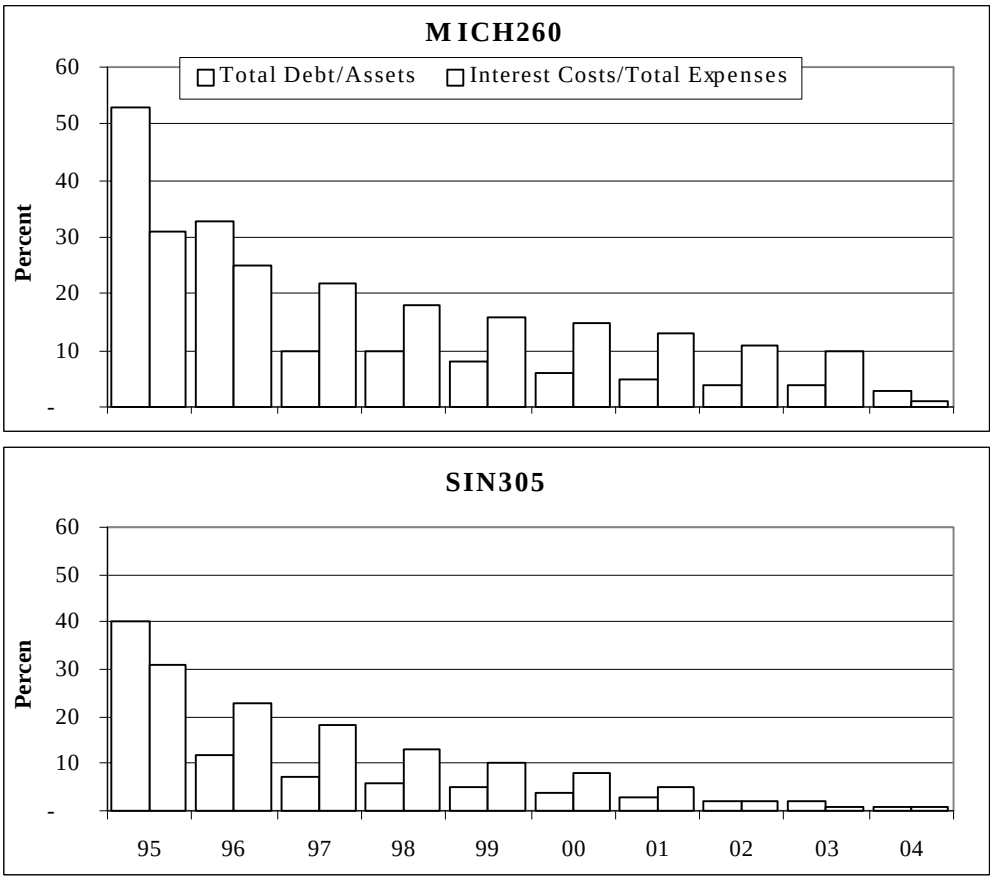


Figure 13. Projected debt to assets and interest cost to total costs ratio Mexican intermediate size hog farms, 1995-2004

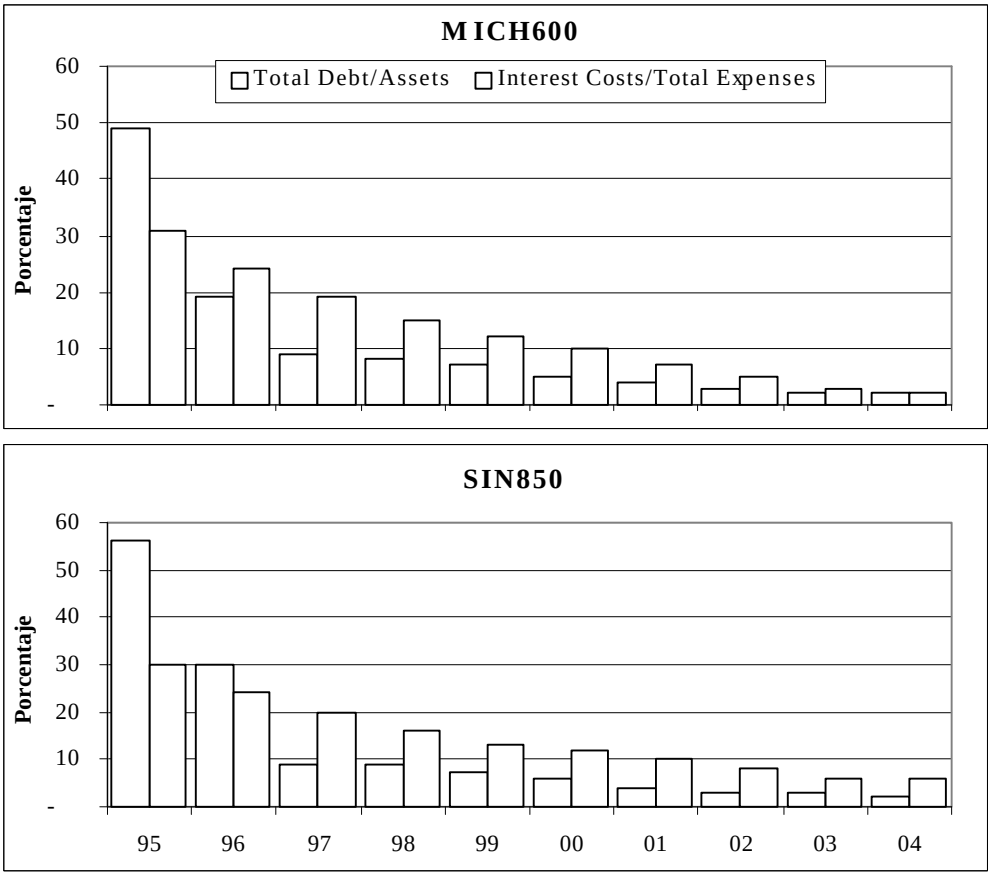
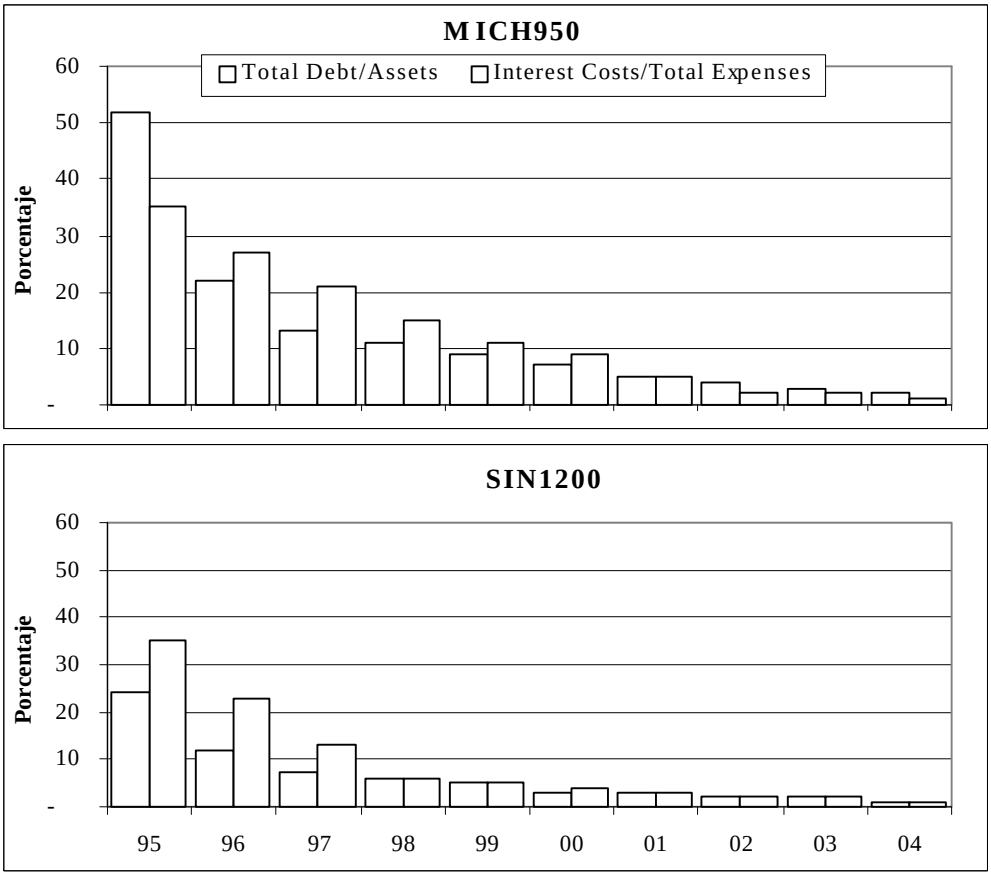


Figure 14. Projected debt to assets and interest cost to total costs ratio Mexican large size hog farms, 1995-2004



4.1. Conclusions

The major study conclusions were as follows:

- All the farms included in this analysis are profitable, but profitability fluctuates cyclically.
- Since no growth was allowed for the farms and the extraction of cash was limited, the cash balances accumulated. Consequently at the end of the planning horizon, the cash balance comprised a considerable proportion of total assets and of real net worth. Therefore, the return to assets and return to equity ratios declined towards the end of the study. That should not be considered as a decrease in the profitability of the hog farms.
- Although some of the economic parameters indicate that the small farms are as efficient as the large ones, there are indications of economies of scale. The economic parameters indicate that the farms in Sinaloa are more efficient than the farms in Michoacan. However, keep in mind that these farms represent case studies and sampling variability is possible.
- Under the financial assumptions of this study, interest costs are an important factor within the total cash costs and in the financial performance of the farms.
- Under the assumptions of this study, MICH260 did not show any financial problems. However, this farm showed financial weakness, given the observed level of net income adjustment (NIA). Consequently, important deviations in the assumptions could negatively affect the economic viability of these types of farms. Similarly, during the market cycle peaks, their economic viability relies on the magnitude of the negative impact in the previous years.

- The economic parameters observed for SIN1200 highlight that the economic viability of the breeding boar production system is much more profitable than the other production systems. However, not all farms can sell breeding stock. In Mexico only a few companies are producing boars. Because of the high level of technology required, the high investment level, and the elevated managerial capacity required by this kind of operation, as well as the number of seedstock producers needed in an industry, few producers are in a position to participate in this segment of the industry.
- The high-technology hog production system in México is characterized as being highly dependent on imported inputs such as feed and breeding stock. The domestic price for feed and hogs follows closely the US hog prices. That situation makes the high-technology hog production system very sensitive to fluctuations in macroeconomic conditions such as exchange and interest rates, as well as the economic policies of the Mexican government and its trading partners. They would correspondingly be sensitive to changes in domestic farm and trade policy.
- Clearly, the profitability of these producers indicates that industry expansion is likely. The projection of increasing hog prices, population and income suggests that Mexico's imports of pork products will continue to expand.

4.2. Final commentary

The information utilized as a basis for this study was collected in 1995. In that year, after the peso devaluation in December 1994, the economic conditions were extremely difficult, both for the hog production as well as for the Mexican economy in general. Therefore, early in the planning horizon (1995-1998), the economic outlook for the farms looked bleak and debt accumulated over the period had a negative impact on the economic

behavior of the farms for the rest of the planning horizon. Late in the planning horizon, although a cyclical performance is observed, the market cycles are projected to be less unfavorable.

The assumptions and projections embedded in this research reflect accurately the reality of the Mexican hog production. Hog producers in Mexico faced the most adverse conditions of the period studied in 1998. Over the 2000-2002 period, improved economic conditions are expected, although a new contraction in 2003 is projected. The economic performance of the farms in 2003 will likely be similar to that observed in 1997.

Although the net income level observed in 1997, relative to net incomes 1996 and 1998, indicates that 1997 was notably favorable for the farms in this study, that relationship cannot be inferred for hog production in general. In past years many hog producers have gone out business and others have had to liquidate part of their herds.

One of the basic assumptions of this analysis is that the farms keep the number of sows constant over the planning horizon. The purpose of this assumption was to reduce the sources of economic and financial variability for the study. In real life conditions, producers liquidate part of the herd to meet cash needs and to continue operating. In future studies, the possibility of liquidating part of the herd during the lowest price segment of the market cycle should be analyzed. Also, the impact of technological and policy changes need to be analyzed.

This study considered constant production parameters for the farms. However, Mexican hog production is showing a structural changes related to production techniques and market access, although these changes are not homogeneous for all the hog producing regions in the country. The farms included in this study are located in two of the main

production regions, whose productive structure and commercialization are different from farms observed in other regions of the country. Technological change and market access affect the economic viability of the hog farms and therefore the output level and the economic performance of this analysis. Future analyses of Mexican hog production need to include other important hog producing regions.

Because of the source of information utilized for this study, the conclusions should be considered preliminary. This research is a case study and demonstrates the potential that farm-level analyses can provide for the Mexican hog industry. Although the results may not be representative of the hog industry in all regions, the cases analyzed here clearly indicate a highly profitable industry with tremendous potential to expand.

Comprehensive studies, utilizing information generated through representative farm panels in all production regions are required. From these studies, valuable information for the hog sector could be obtained. Analyzing and understanding the cyclic performance of the hog production is fundamental. The proposed approach should facilitate the generation of agricultural policies oriented towards enhancing the economic future of the hog sector and the decision-making process by producers to achieve a better financial position. With this added information producers, leader and policy makers would be in a better position to make rational decisions considering the risks that are inherent in hog production.

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Appendix 1. Hog Farms Description

MICH260 Farrow-to-finish farm located in the State of Michoacan. The farm manages 260 sows and 3 boars. The investment per sow is of MX$ 7,324.00 in 1995. The labor employed is 56 hours per sow a year. The feed consumption is 127 cwt per sow a year. The annual production of the farm is 9,814 cwt, that means 15.55 hogs per sow a year. The feed conversion is 3.2420 pounds of feed per pound of produced pork (Table A.1.).

MICH600 Farrow-to-finish farm located in the State of Michoacan. The farm manages 600 sows and 5 boars. The investment per sow is of MX$ 7,539.00 in 1995. The labor employed is 97 hours per sow a year. The feed consumption is 136 cwt per sow a year. The annual production of the farm is 25,366 cwt, that means 17.73 hogs per sow a year. The feed conversion is 3.1327 pounds of feed per pound of produced pork (Table A.1.).

MICH950 Farrow-to-finish farm located in the State of Michoacan. The farm manages 950 sows and 10 boars. The investment per sow is of MX$ 6,842.00 in 1995. The labor employed is 28 hours per sow a year. The feed consumption is 100 cwt per sow a year. The annual production of the farm is 29,734 cwt, that means 14.18 hogs per sow a year. The feed conversion is 3.0632 pounds of feed per pound of produced pork (Table A.1.).

SIN305 Farrow-to-finish farm located in the State of Sinaloa. The farm manages 350 sows and 18 boars. The investment per sow is of MX$ 7,196.00 in 1995. The labor employed is 86 hours per sow a year. The feed consumption is 133 cwt per sow a year. The annual production of the farm is 12,566 cwt, that means 19.17 hogs per sow a year. The feed conversion is 3.2219 pounds of feed per pound of produced pork (Table A.1.).

SIN850 Farrow-to-finish farm located in Culiacán, Sinaloa. The farm manages 850 sows and 55 boars. The investment per sow is of MX$ 6,879.00 in 1995. The labor employed is 82 hours per sow a year. The feed consumption is 140 cwt per sow a year. The annual production of the farm is 34,362 cwt, that means 19.27 hogs per sow a year. The feed conversion is 3.3653 pounds of feed per pound of produced pork (Table A.1.).

SIN1200 Farrow-to-finish farm located in Los Mochis, Sinaloa. The farm manages 1,200 sows and 74 boars. The investment per sow is of MX$ 10,945.00 in 1995. The labor employed is 78 hours per sow a year. The feed consumption is 137 cwt per sow a year. The annual production of the farm is 49,839 cwt, that means 18.82 hogs per sow a year. The feed conversion is 3.0976 pounds of feed per pound of produced pork (Table A.1.).

Table A.1. Technical parameters of Mexican hog farms

	MICH260	MICH600	MICH950	SIN305	SIN850	SIN1200
Livestock						
Sows (units)	260	600	950	305	850	1,200
Boars (units)	3	5	10	18	55	74
Total assets (MX$)						
Buildings	733,600	1,646,000	2,542,000	600,000	1,297,304	6,092,267
Machinery	244,800	539,196	10,009,100	416,578	1,371,839	1,371,922
Livestock	925,929	2,338,220	2,948,373	1,349,944	3,178,041	5,669,395
Parameters (per sow)						
Investment (MX$)	7,324	7,539	6,842	7,196	6,879	10,945
Labor (hours)	56	97	28	86	82	78
Feed (cwt/year)	127	136	100	133	140	136
Pigs/year	15.55	17.73	14.18	19.17	19.27	18.82
Technical parameters						
Production (cwt/year)	9,814	25,366	29,734	12,566	34,362	49,839
Feed conversion	3.2420	3.1327	3.0632	3.2219	3.3653	3.0976

Appendix 2. Economic Parameters

Table A.2.1. Projected cash receipts, cash expenses, and cash net income of Mexican hog farms, 1995-2004

YEAR	MICH260	MICH600	MICH950	SIN305	SIN850	SIN1200
Total cash income (MX$1 000)						
1995	2,737	7,034	8,305	3,492	9,866	16,499
1996	4,143	10,648	12,573	5,286	14,926	25,761
1997	5,098	13,105	15,473	6,505	18,369	31,129
1998	4,429	11,384	13,442	5,651	15,957	26,667
1999	4,789	12,309	14,534	6,110	17,252	28,843
2000	5,808	14,928	17,625	7,409	20,923	34,978
2001	6,447	16,570	19,565	8,225	23,225	38,826
2002	6,336	16,285	19,228	8,083	22,825	38,159
2003	6,243	16,047	18,947	7,965	22,491	37,601
2004	7,105	18,261	21,561	9,064	25,594	42,788
Average 1995-2004	5,313	13,657	16,125	6,779	19,143	32,125
Total cash expenses (MX$1 000)						
1995	3,324	8,115	9,560	3,837	11,711	15,270
1996	3,816	9,189	10,472	4,334	13,404	15,919
1997	3,942	9,317	10,368	4,399	13,717	15,251
1998	4,198	9,864	10,818	4,624	14,497	15,859
1999	4,523	10,552	11,384	4,948	15,560	17,260
2000	5,193	12,036	12,841	5,640	17,820	19,827
2001	5,490	12,642	13,304	5,924	18,785	21,284
2002	5,764	13,176	13,825	6,167	19,633	22,677
2003	6,055	13,731	14,582	6,449	20,519	23,970
2004	6,419	14,464	15,379	6,824	21,699	25,318
Average 1995-2004	4,872	11,308	12,253	5,315	16,734	19,263
Total cash net income (MX$1 000)						
1995	(588)	(1,080)	(1,255)	(345)	(1,845)	1,229
1996	326	1,459	2,101	951	1,522	9,841
1997	1,156	3,788	5,105	2,106	4,652	15,878
1998	231	1,520	2,624	1,027	1,460	10,807
1999	266	1,757	3,149	1,162	1,692	11,583
2000	615	2,892	4,785	1,769	3,102	15,151
2001	956	3,929	6,261	2,300	4,440	17,543
2002	572	3,109	5,403	1,916	3,192	15,482
2003	189	2,316	4,366	1,517	1,972	13,631
2004	685	3,797	6,182	2,240	3,896	17,470
Average 1995-2004	441	2,349	3,872	1,464	2,048	12,862

Table A.2.2. Projected expenses to receipts ratio, real net worth and cash balance of Mexican hog farms, 1995-2004

YEAR	MICH260	MICH600	MICH950	SIN305	SIN850	SIN1200
Expenses/receipts ratio (%)						
1995	121	115	115	110	119	93
1996	92	86	83	82	90	62
1997	77	71	67	68	75	49
1998	95	87	80	82	91	59
1999	94	86	78	81	90	60
2000	89	81	73	76	85	57
2001	85	76	68	72	81	55
2002	91	81	72	76	86	59
2003	97	86	77	81	91	64
2004	90	79	71	75	85	59
Average 1995-2004	93	85	79	80	89	62
Real net worth (MX $1 000)						
1995	974	2,490	3,353	1,387	2,664	11,415
1996	1,660	4,733	6,553	2,582	5,055	22,385
1997	2,438	7,168	9,868	3,803	8,058	31,498
1998	2,019	6,585	9,536	3,546	6,978	33,165
1999	1,992	6,906	10,373	3,736	7,108	36,558
2000	2,252	7,996	12,198	4,322	8,258	41,933
2001	2,539	9,213	14,189	4,969	9,585	47,409
2002	2,485	9,578	15,122	5,193	9,763	50,503
2003	2,218	9,411	15,274	5,179	9,335	51,876
2004	2,287	10,131	16,513	5,601	10,085	55,487
Average 1995-2004	2,086	7,421	11,298	4,032	7,689	38,223
Cash balance (MX $1 000)						
1995	(720)	(1,361)	(1,594)	(512)	(2,222)	628
1996	(608)	(304)	(34)	194	(1,321)	9,525
1997	329	2,934	4,370	1,945	2,662	23,848
1998	85	3,520	5,715	2,390	2,699	33,109
1999	96	4,678	8,075	3,168	3,630	43,894
2000	239	6,614	11,431	4,308	5,140	57,734
2001	653	9,429	16,037	5,894	7,777	73,776
2002	782	11,583	20,217	7,237	9,733	88,495
2003	382	12,679	22,905	7,999	9,750	101,010
2004	660	15,590	28,058	9,727	12,515	118,425
Average 1995-2004	190	6,536	11,518	4,235	5,036	55,044

Table A.2.3. Projected return to asset and return to equity ratios of Mexican hog farms, 1995-2004

YEAR	MICH260	MICH600	MICH950	SIN305	SIN850	SIN1200
Return/assets ratio (%)						
1995	31	41	41	44	32	65
1996	73	87	81	91	81	103
1997	76	88	81	88	90	66
1998	30	30	30	29	31	28
1999	32	30	29	29	31	25
2000	39	34	32	32	38	25
2001	36	30	28	28	34	22
2002	22	19	18	18	20	16
2003	11	10	11	11	11	11
2004	20	15	14	15	18	12
Average 1995-2004	37	38	37	38	39	37
Return/equity ratio (%)						
1995	(29)	(22)	(18)	(15)	(41)	30
1996	59	82	89	80	66	105
1997	70	77	76	74	82	68
1998	11	19	23	21	14	28
1999	14	21	25	22	16	25
2000	22	27	29	27	24	25
2001	24	26	27	26	25	22
2002	13	17	18	17	14	16
2003	1	9	11	10	6	10
2004	10	14	14	15	13	12
Average 1995-2004	20	27	29	28	22	34

Table A.2.4. Projected total debt, total debt to total asset and financial cost to total expenses ratios of Mexican hog farms, 1995-2004

YEAR	MICH260	MICH600	MICH950	SIN305	SIN850	SIN1200
Total debt (MX$1 000)						
1995	1,100	2,407	3,734	934	3,463	3,684
1996	984	1,336	2,145	417	2,546	3,634
1997	368	1,010	2,066	408	1,200	3,554
1998	358	983	2,011	397	1,168	3,458
1999	343	942	1,928	381	1,120	3,312
2000	324	890	1,820	360	1,058	3,125
2001	299	819	1,676	332	975	2,874
2002	267	731	1,495	296	870	2,560
2003	228	625	1,278	254	745	2,187
2004	183	501	1,024	204	598	1,749
Average 1995-2004	445	1,024	1,918	398	1,374	3,014
Total debt/assets ratio (%)						
1995	53	49	52	40	56	24
1996	33	19	22	12	30	12
1997	10	9	13	7	9	7
1998	10	8	11	6	9	6
1999	8	7	9	5	7	5
2000	6	5	7	4	6	3
2001	5	4	5	3	4	3
2002	4	3	4	2	3	2
2003	4	2	3	2	3	2
2004	3	2	2	1	2	1
1995-2004	14	11	13	8	13	6
Financial cost/total expenses						
1995	31	31	35	31	30	35
1996	25	24	27	23	24	23
1997	22	19	21	18	20	13
1998	18	15	15	13	16	6
1999	16	12	11	10	13	5
2000	15	10	9	8	12	4
2001	13	7	5	5	10	3
2002	11	5	2	2	8	2
2003	10	3	2	1	6	2
2004	10	2	1	1	6	1
1995-2004	17	13	13	11	15	9