DAIRY INDUSTRIALIZATION AND SPRAWL IN AN UPSTATE NEW YORK COUNTY

A Thesis

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by

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ABSTRACT

In this thesis I examine the interaction of agricultural industrialization and sprawl in an upstate New York county. A longitudinal representative case study of dairy farming in Ontario County, NY was conducted in order to evaluate the efficacy of the treadmill of technology and impermanence syndrome hypotheses in explaining dairy farm survival and expansion. According to the treadmill of technology hypothesis, larger farmers are more likely to adopt capital and management-intensive technology. They are then more likely to expand their operations in part to increase the returns on their investment. Those farmers that do not adopt these technologies are more likely to exit agricultural production. The impermanence syndrome hypothesis, on the other hand, holds that farms located in areas experiencing urban sprawl are likely to experience a number of negative externalities, including complaints about their operations. These farmers are less likely to continue investing in their farms because they foresee selling their land to developers. These farmers are thus more likely to exit agricultural production.

The case study site, Ontario County, NY, was chosen because it has experienced many of the processes representative of the Northeast. Namely, the County is a traditional dairy farming area where the number of farms has been declining and the size of farms increasing. Also, the traditionally rural County is experiencing increasing urban sprawl emanating from Rochester.

I collected primary and secondary qualitative and quantitative data on the County in order to build the case study. Qualitative data included numerous site visits and interviews with community leaders and residents in order to understand the historical and socio-economic context. Quantitative data included Census of Agriculture data on the County's agricultural sector, with particular emphasis on dairy

farming. I also used national Census data and tax parcel data to chart population and housing flows as well as the conversion of farmland to non-agricultural uses. Finally, the case study hinges upon surveys conducted on a group of Ontario County dairy farmers in 1993, 1998, and 2002. While the original intention of the study was to follow 50 dairy farmers over a 10 year period, the high number of farm exits among the group made this impossible. As such, my thesis discusses the results of the initial survey along with the farmers still dairy farming in 1998 and 2002.

Employing the analytic technique of pattern matching, the case study produced contradictory findings in terms of the two hypotheses examined. In terms of the treadmill of technology hypothesis, the on-farm panel surveys showed that adopting capital-intensive technologies increased the likelihood of expanding production to become a very large dairy farm but did not necessarily ensure that the farm would continue dairy farming. In terms of the impermanence syndrome hypothesis, the results show that scholars must be more precise when operationalizing their studies. While scholars have generally used the perception of sprawl as a proxy for objectively measured sprawl, the perception of sprawl was strongly associated with farm exit in the 1993 survey with objective sprawl being a stronger indicator in the 1998 survey. Likewise, complaints from neighbors were more associated with the size of the dairy farm than the existence of urban sprawl.

I showed that the treadmill of technology and impermanence syndrome hypotheses should not necessarily be seen as rival hypotheses but rather complement one another. That is, farms located in more rural areas are more likely to expand their production than those located in sprawl areas. Also, larger farms are more likely to perceive sprawl, in part because they are more likely to receive complaints.

BIOGRAPHICAL SKETCH

W. Chad Futrell was raised on a mixed-crop farm in Southeastern North Carolina. Attending local schools until the age of 16, Chad left his hometown to attend the North Carolina School of Science and Mathematics. Chad then attended the University of North Carolina at Chapel Hill where he studied religious studies and economics. He also spent his junior year abroad at the University of Sussex in the United Kingdom where he focused on European philosophy, particularly existentialism and postmodernism. During his time at UNC and Sussex, Chad participated and led several student environmental and social justice groups, including the Student Environmental Action Coalition.

After graduating from UNC, Chad used a Frances B. Philips Travel Scholarship to study the interaction of Buddhism and Daoism at a temple in South Korea. At the conclusion of the scholarship Chad began volunteering at the Korean Federation for Environmental Movement and teaching English. After three years in Korea, Chad entered Cornell University in order to study Environmental Management in the Department of Applied Economics and Management through a joint program with the Peace Corps. Upon meeting several of the professors in the Department of Development Sociology, however, Chad transferred in order to pursue an M.S. and Ph. D in that department. In preparation for dissertation research Chad returned to Korea during the summers for intensive Korean instruction at Yonsei University and is currently enrolled in advanced Korean classes at Sogang University in Seoul. Chad also spent the 2003-2004 academic year studying in Cornell’s Department of Asian Studies’ intensive Chinese FALCON program, receiving a Certificate for advanced Mandarin after the Spring semester at Tsinghua University in Beijing.

I would like to dedicate this thesis to the farmers of southeastern North Carolina, especially those farmers who lost their farms because of factors beyond their control.

ACKNOWLEDGMENTS

As is always the case in projects as large and time-consuming as a Master's thesis, there are many people without whose help I would not have been able to complete this thesis. I would like to first thank my committee of Thomas Lyson, Max Pfeffer, and Gilbert Gillespie. Their guidance and patience in commenting on successive drafts helped me write a much clearer and more focused thesis. Gil especially went beyond the call of duty in giving feedback throughout the research process and did a lot of the little things necessary to carry the project through to fruition. I would also like to thank the scholars involved in the USDA NE-177 project on the Structural Transformation of the Dairy Industry, without whose research support I would not have been able to make the numerous site visits necessary to fully understand the processes examined. This research project was important to me both academically and personally because of my own farming background. Courses and conversations with Tom, Gil, and Phil McMichael helped me understand the local and global processes that transformed my hometown of Duplin County, NC from a mixed-farm agricultural area to one of the hubs of industrial hog farming. I would like to thank Hannah Witman and Rachel Bezner-Kerr for comments on early drafts as well as Megan Pile-Spellman, Mike Craig, and Gayatri Menon for similar help on later iterations. Also, taking and later TAing quantitative methods courses with Joe Francis helped me understand logistical regression and other multivariate methods.

While I learned an immense amount through writing this thesis, I must admit that much of what I have learned during my time at Cornell had little to do with dairy farming or sprawl. I transferred from Applied Economics to Development Sociology because I was immensely stimulated by my conversations with Development Sociology faculty and students. I have never regretted my transferring, and believe that Development Sociology and Cornell are the best places in the world to study my

passions; namely agriculture, the environment, social movements, and East Asia. Indeed, from my first class in the department, Tom, Phil, Chuck Geisler and others constantly challenged my thinking on these and other topics.

In terms of intellectual stimulation as well as friendship, I would be remiss if I did not mention Rajeev Patel, Andreas Hernandez, and Malinda Seneviratne. I consider all three of these amazingly unique individuals to be brothers, their intellectual creativity and sheer passion for both life and social justice a constant reminder to continually strive to make things even a little bit better. Likewise, Kelly Dietz, Hannah, Anna Zalik, and Hyun-ok Lee are sisters whose commitment to activism both local and global continually inspires me. I transferred to Development Sociology in part because of the engaged academic activism pursued by Raj, Kelly, and others, and will always look back fondly and with pride at the seminal role of our grad students in starting both the Ithaca Coalition for Social Justice and The Cobbler Newspaper.

I would thus like to thank groups involved with my study of Korea and China, starting with the inspiring activists at the Korean Federation for Environmental Movement. Conversations with and TAing for Prof. Chul-Kyoo Kim, a department alum and Korea University professor, helped me understand Korea's recent history more fully. The amazing Chinese teachers at Cornell's FALCON program and Tsinghua University's IUP program, and the Korean teachers at Sogang University deserve special mention for dragging me towards fluency. I truly did not believe I could learn these brutally difficulty languages, but having given academic talks in both, I am now a believer. I will always be especially indebted to Stephanie Hoare-Divo (He Laoshi) for selecting me for the summer and AY FALCON FLAS fellowships. Likewise, the staff at Cornell's East Asia program deserve praise for continually securing funding so that I could spend every summer either in Korea or China.

Cornell is a special place because of the strength of its various programs as well being located in Ithaca. I have probably explored the various communities nestled in these settings more than the average graduate student, and have benefited enormously by doing so. I would like to thank Brenda Wickes for hiring me to be a Graduate Community Assistant at Hasbrouck Apartments. The Hasbrouck staff and community were wonderful diversions from my studies, and I will always appreciate the residents being patient with my faulty Korean and Mandarin. Also, some of my most engaging and stimulating conversations were in Sibley Hall with the architecture students. I especially thank Justin Cipriani and Joseph Beneviste for helping me conceptualize space in new ways as we explored the forests and gorges around the Finger Lakes. I would like to thank Aaron Kofner and the Ithaca College crew for introducing me to a lot of amazing music. Likewise, Andreas introduced me to Nathan Newman and the rest of the Chateau, a place full of laughter and goodwill.

Finally, I would like to thank Anna, Hannah, Hyun-ok, Gayatri, and Kyungwoon Chang for many delicious meals and for letting me crash at their places more often than was polite. Kyungwoon in particular supported me as much as she possibly could. All of my achievements, including this thesis, would not have been possible without the unwavering love and support of my family. My brother Marty has always inspired me by his dedication and hard work. Likewise, my mother, Brenda, has supported me through thick and thin, and has been more than understanding of my spending most of my adult life in Asia. I would like to end these acknowledgements by thanking my father Jimmy, grandfather James, and great uncle Mort for teaching me about farming, both its good and bad aspects, and for raising me to treat all people with respect and kindness. I truly believe that it is my family and farming background that have enabled me to connect so easily with the farmers and activists of Korea and China.

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CHAPTER 1

INTRODUCTION, RESEARCH QUESTIONS, LITERATURE REVIEW, AND STUDY RATIONALE

Agriculture in the United States is changing. The number of farms has dropped dramatically during the later part of 20th Century while farm size and production has grown (Hurt 2002). Farm productivity has increased steadily as capital and management-intensive technologies have become more widespread (Kneen 1993). The bulk of production is increasingly from farms which are highly specialized operations organized along "industrial" lines (Welsh 1996; Gardner 2002), with the largest 2% of all farms now accounting for half of America's annual agricultural production (USDA 2002). As will be discussed below, this restructuring has been driven in part by a process called the "the treadmill of technology" (Cochrane 1993). The structural transformation of agriculture has not been homogenous, however, varying widely across both geographic regions and commodity sectors (Reimund *et al*. 1981). Poultry, for example, industrialized and consolidated much earlier than other commodities (Heffernan 1984).

The structural transformation of agriculture outlined above has been taking place amidst state, regional, and national demographic flows of populations moving in as well as out of cities (Johnson and Beale 1994). America's countryside is currently changing as people from urban and suburban centers spread into formerly rural, agricultural areas. The resulting sprawl, or low-density development, and the conversion of farmland to non-agricultural uses have become important national issues (American Farmland Trust 1994). The relationship of farm consolidation to farmland conversion is even more troubling when one considers that urbanization may accelerate farm exits through a process rural sociologists and agricultural economists have referred to as the "impermanence syndrome" (Berry 1978). That is, farmers in urbanizing areas become subject to a number of effects of urbanization, including rising land values and property taxes as well as conflicts with non-farm residents, especially such residents who have recently moved to an area (Nelson 1992). These effects can lead farmers to stop investing in their farms, which along with the lure of high land prices from developers, may accelerate farmers' departures from dairy and other land-intensive agriculture production (Long 1992).

Research Questions

I am primarily concerned with the intersection of these two previously outlined very large and prevalent processes in the United States: the consolidation and industrialization of agricultural production and the persistent spread of low-density development, or sprawl, into rural areas. I am particularly interested in investigating whether the treadmill of technology hypothesis (Cochrane 1993) or the impermanence syndrome hypothesis (Berry 1978) better explains the changes taking place in dairy production in the urbanizing Northeast. The focus of my investigation is Ontario County, NY, a county chosen to be representative dairy farming in the urbanizing Northeast. I conducted interviews with community residents and leaders and collected quantitative and historical secondary data on the County's socio-economic, demographic, and agricultural trends. This research provided the background for the case study while guiding my analysis of a panel of 48 dairy farmers initially surveyed in 1993, with subsequent surveys in 1998 and 2002. I triangulate these data sources and then analyze them using a method referred to as "pattern matching" (Yin 2003) to address the following set of questions:

1) Is dairy farming in Ontario County consolidating into fewer, larger farms? If so, what characteristics signal that a dairy farm will continue producing milk? What characteristics indicate that a farm will expand its scale of production?

2) Is Ontario County experiencing sprawl? How is the sprawl distributed across the County? Is there evidence of the impermanence syndrome--that is, are farms located in sprawl areas more likely to exit dairy production? Are they less likely to expand the scale of their operations?

3) Which is the more dominant process, the structural transformation of dairy production via processes like the treadmill of technology or the impermanence syndrome?

Significance of Research

Ironically, the structural transformation of agriculture and sprawl express themselves in geographically specific ways, yet may have similar homogenizing consequences. While the details of agricultural restructuring are commodity specific, there are also similarities in consolidation and industrialization across commodities (Welsh 1996). Likewise, urban fringe areas are expanding outwards all across the United States as suburbs become differentiated economic centers (Nelson and Deuker 1998). These two processes, urban growth and agricultural restructuring combine to convert farmland into non-agricultural uses at the rate of one million acres of farmland per year (American Farmland Trust 1996). Given the magnitude of farmland loss, understanding how these two processes express themselves jointly in particular areas is needed.

A single agricultural sector was chosen for this study because of the theoretical and methodological difficulties of comparing structural transformations across regions and commodities. Given that dairy production is undergoing a structural transformation similar to the previous transformations of the poultry and hog industries (Sharp *et al.* 2002), this study is intended to contribute to understanding agricultural restructuring as a whole. Finally, focusing on one sector and location allows for thicker description, showing more aspects of the interaction of agricultural restructuring and sprawl than would be possible in broader studies.

The dairy industry is a good candidate for analyzing the processes of structural transformation and urban sprawl because it is still the largest agricultural sector for many states, particularly in the Northeast and northern Midwest. Unlike with some commodities, each state contributed to the 165.3 billion pounds of milk produced in the U.S. in 2001, so dairy is also a good candidate for study because it makes important contributions to local and state economies while providing a number of amenities such as open-space (Heimlich and Anderson 2001). Indeed, researchers at Cornell University found that the dairy industry produces the largest income multiplier effects of any industry in New York State, agricultural or otherwise (Bills *et al.* 1995; Jack *et al.* 1996a; Jack *et al.* 1996b). Dairy production has an income multiplier effect of 2.29 compared to 1.78 for nursery and wood products, and 1.64 for poultry and livestock.[1] Also, of all of production agriculture, dairy production contributes the most to local employment opportunities with an employment multiplier effect of 1.52, comparing quite favorably with other economic sectors as well.[2]

These large income and employment multiplier effects indicate that dairy farms tend to spend more of their money in their local communities than do other industries. These numbers are supported and supplemented by Love's findings that dairy farms interact more with local businesses than do other farms (Love 1995). Also, Lyson and Gillespie's (1995) finding that large dairy processors articulate with

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[1]The authors define total income multipliers as "the change in the sum of employee compensation, proprietary income from self-employment, and other property income per $1 of direct increase in regional income or payrolls" (Jack *et al.* 1996a:2). They calculated the multiplier estimates using IMPLAN, a program which generates regional estimates based on national data and coefficients developed by the U.S. Department of Commerce.

[2]Employment multipliers "account for the total change in full-time equivalent (FTE) jobs associated with the direct creation of an initial job to produce output" (Jack *et al.* 1996a:2).

large dairy farms, along with Love's (1995) finding that a rapid decline in farm numbers can lead to the decline of grain operators and other businesses, means that changes in local dairy production can be expected to have ripple effects throughout local economies. Indeed, not surprisingly given the changes in dairy production, milk processing in New York State underwent consolidation throughout the 1990s, with the number of dairy plants dropping from 115 in 1990 to 87 in 2000, a decline of 32% (N.Y. State Agricultural Statistics Service 2000).

Dairy farming is particularly important in terms of farmland conversion because it uses more land than many other forms of agriculture (Berry 1979), and is disproportionately located in metro and metro fringe counties (Heimlich and Anderson 2001). Indeed, as much as 79% of all milk produced in the United States, is produced in urban-influenced counties (American Farmland Trust 1996). While municipalities and states have been enacting a variety of zoning ordinances and other policies seeking to promote "smart growth," a growing understanding is that one of the best ways to preserve farmland is to have a strong farm economy (Freedgood 1991; American Farmland Trust 1994). Maintaining a strong farm economy is particularly difficult, however, if the impermanence syndrome is indeed prevalent and agricultural consolidation is accelerated by sprawl.

Given that neither the structural transformation of dairy production nor the spread of suburban sprawl show any signs of abating, it is imperative that scholars, government officials, dairy farmers, and community members residents better understand how these two processes interact so that the resulting changes can be better managed.

Literature Review

Farm Industrialization

The industrialization of agriculture has not been uniform across agricultural commodities and geographic locations (Reimund *et al.* 1981). At the industry level, agricultural industrialization has emerged with the concomitant consolidation of agricultural production, with fewer, larger, and more specialized farms coming to dominate agricultural production (Kneen 1993; Cochrane 1993; North 2002). The overall goal of an industrially-organized farm is to raise profit margins by emphasizing efficiency, especially in regards to inputs per production output unit. Welsh (1996) and others, have identified some common farm level characteristics of agricultural industrialization that differentiate industrial farms from other forms of agriculture. First and foremost, industrial farms are characterized by ever-expanding farm operations. Second, industrial farms are distinguished by the increasing use of managerial and cost accounting. Third, capital in the form of expensive machinery and chemical inputs is used aggressively to replace labor. Fourth, industrial farms rely more on hired labor, and the tasks farm workers perform are increasingly specialized and routinized. Fifth, industrial farms tend to specialize in the production of single commodities, rather than the baskets of commodities that characterized traditional family farms in the United States until very recently.

The influential agricultural economist Willard Cochrane (1993) posited that larger farms are more likely to industrialize, and that a process he termed the "treadmill of technology" promotes both farm consolidation and the expansion of larger farms (see also Buttel *et al.* 1990). According to Cochrane, larger farmers tend to be willing and able to adopt new labor saving and output enhancing technologies before they are in common usage. Using the new technologies, these "early adopters" are able to capture "innovators' rents" through lowering their marginal, or per unit costs. Cochrane held that this micro process has macro effects because the early adopters increase production in pursuit of profits and this increased production in markets with limited demand depresses commodity prices, which in turn adversely affects other farmers, especially those typically smaller, more risk-adverse farmers who were slow to adopt the new technologies. The depressed commodity prices then forces non-adopters to either adopt the new technology--not to capture rents but rather to merely keep up--or to leave agricultural production because they are not competitive economically.

Agricultural technologies can be divided into three kinds: yield-increasing, labor-saving, and environmental protecting (the latter having a somewhat different dynamic—see Buttel *et al.* 1990: 61-63--and is outside the scope of this thesis). Farmers with small and medium size farms can more easily adopt yield-increasing technologies such as fertilizers, hybrid seeds, and pesticides because these technologies tend to be divisible, and thus can be bought and applied at levels appropriate to each individual farm. Labor-saving technologies, on the other hand, often come in the form of expensive machinery which must pay for itself by reducing the production cost per unit. However, to capture economies of scale and recoup their capital investments under conditions of low prices for the commodities they produce, farmers often must expand their operations to generate adequate net incomes. Therefore, while yield-increasing technologies tend to be somewhat scale neutral, labor-saving technologies almost always have scale effects, further driving the technological treadmill.

Heffernan (1984) and Rodefeld (1974) were two of the first rural sociologists to understand the structural implications of the technological treadmill. The poultry industry was the first livestock commodity to consolidate and vertically integrate (Heffernan 1984), and has served to some extent as the blueprint for structural change in other livestock sectors. Agricultural production systems and their restructuring have also varied by region (Rodefeld 1974) and social system (Pfeffer 1983).

Consolidation and Industrialization of Dairy Production

While the dairy industry consolidated and integrated later than the poultry industry (Geisler and Lyson 1991), by the late 1980s it had become obvious that dairy production was also restructuring towards fewer, larger, and more specialized farms. Table 1.1 shows the rapid decline in the number of farms with dairy herds along with the increasingly specialized production of dairy farms. While the total number of cows has also declined, total milk production has increased through a dramatic rise in dairy herd averages, or the amount of milk produced by a single cow in a year. Indeed, a bundle of technologies and practices aimed at increasing milk production have more than tripled production per cow since 1950 (Lyson and Gillespie 1995).

Table 1.1: U.S. Dairy Farms, Cows, and Milk Production

Year	Dairy Farms	% Farms with dairy cows	% Dairy Farms special-ized[1]	Total Cows	Cows Per Farm	Total Milk Production (millions of lbs)	Herd Average (lbs milk/cow/ year)
1950	3,681,627	68.3%	16.5%	21,994	6	116,602	5,314
1959	1,836,785	49.5%	23.9%	17,901	9	121,989	6,815
1969	568,237	20.8%	45.9%	12,307	20	116,108	9,434
1978	369,210	13.8%	52.8%	10,803	27	121,461	11,243
1987	227,880	9.7%	67.1%	10,327	45	142,709	13,819
1997	123,700	6.1%	71.9%	9,252	75	156,091	16,871

Source: USDA Census of Agriculture various years; Blayney 2002.

[1] Specialized dairy farms are those which receive 75 percent or more of their cash receipts from milk and dairy animal sales.

As Reimund, Martin, and Moore (1981) found with broilers and beef cattle, dairy underwent a geographic shift as new technologies emerged. Table 1.2 shows how dairy production has shifted from the historical milk-producing states in the Northeast and Midwest towards the West and Southwest. States such as California and Idaho have seen phenomenal growth both in terms of the total number of cows and milk production per cow while traditional dairy states like Wisconsin and Minnesota have witnessed dramatic drops in the number of cows, particularly after 1988. Perez (1994) holds that this shift is driven by population growth and the concomitant increase in demand for fluid milk, which has long needed to be produced locally. Also, farmers in the West and Southwest do not have to build expensive housing facilities to enable their cows to withstand the harsh winters of the Midwest and Northeast (Fallert and Blayney 1990). Furthermore, Weersink and Tauer (1991) found that dairy operations in the West have become larger to take advantage of economies of size, but that dairy production practices should eventually converge and homogenize. In contrast, Gilbert and Akor (1988) hold that dairy restructuring, rather than converging, would be characterized by a dual mode of production with farmers in traditional dairy-producing areas remaining viable without expanding their scales of production. Lyson and Geisler (1993; Geisler and Lyson 1991) responded to Gilbert and Akor by showing that industrial dairy production is on the rise in the Northeast. Later work by Gilbert and Wehr (2003) shows that the rise of industrial dairy farming in California was driven largely by urbanization. Urbanization increased property values, thus enabling dairy farmers to sell the farms closer to cities, and then to use the proceeds to buy land further out and to build new, larger facilities.

Table 1.2: Total Cows and Herd Average, Top 10 States by Milk Production

State	Total Cows (1,000s)			% Δ		Milk per cow (lbs/cow/yr)			% Δ
	1978	1988	1998	1978-1998		1978	1988	1998	1978-1998
California	846	998	1,420	68		14,018	17,966	19,422	39
Wisconsin	1,881	1,795	1,369	-27		11,735	13,816	16,685	42
New York	906	858	701	-23		11,488	13,331	16,748	46
Pennsylvania	700	721	623	-11		11,259	14,123	17,411	55
Minnesota	837	823	551	-34		10,859	12,680	16,833	55
Idaho	141	168	292	107		11,979	15,643	19,743	65
Texas	311	329	352	13		11,039	13,070	15,923	44
Michigan	403	361	300	-26		11,893	14,537	17,970	51
Washington	186	208	248	33		14,349	18,091	21,476	50
Ohio	384	370	264	-31		11,133	13,014	16,629	49

Source: *Agricultural Statistics*, USDA-NASS, 1979, 1989, individual state bulletins for 1998.

Demographics, development, and farmland conversion

Demography has long been an important aspect of rural sociology in part because of the large influence of migration in most of the 20th century, mostly from rural communities to urban centers (Fuguitt 1985). Declining fertility, with both rural and farm populations declining, is another important demographic influence. The migration trend has flip-flopped over the past three decades, however, as many rural areas gained in population in the 1970s, lost population again during the urban re-concentration of the 1980s, and then again began gaining population again after 1990 (Fuguitt and Brown 1990; Johnson and Beale 1994; Brown *et al.* 1997). These population flows are important for the case at hand as rural areas in Ontario County, NY have experienced these patterns. Rapid population increases in the 1970s were followed by population outflows in the 1980s and then population gains in the 1990s (Brown *et al.*1997; Fulton *et al.* 1997).

The growth of exurban areas along the periphery of urban areas in the 1970s led to a redefinition of Metropolitan Statistical Areas (MSAs)[3] to include adjacent rural counties (Heimlich and Brooks 1989). Many of these fringe counties, such as Ontario County, experienced substantial population growth in the 1990s. Nelson (1992) characterizes ex-urbanization or exurban growth as the outward expansion of suburban and urban households into formerly rural areas (Davis, Nelson, and Dueker 1994). Exurbs, being located on the edge of an MSA's suburbs, generally have low population densities, small local populations located in villages and towns, and large rural areas.

While urban development has been characterized by growth around a core city, advances in transportation and communications technology, along with the growth in less centralized manufacturing and service sectors, has also led to "leapfrog development" within the "rural" areas of MSAs. This pattern of development, characterized by intermittent development centers along transportation corridors especially characterizes MSAs in the Northeast, where more than 80% of land located in MSAs is rural (Pfeffer and Lapping 1995).

While suburban and exurban sprawl, and leapfrog development are different forms of urbanization, they all lead to the conversion of farmland to non-agricultural uses. The American Farmland Trust estimates that over one million acres of farmland

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[3] Now to qualify as an MSA the following criteria must be met: a city with 50,000 or more inhabitants or a Census Bureau-defined urbanized area (of at least 50,000 inhabitants) and a total metropolitan population of at least 100,000. The county or counties containing the largest city in the MSA are designated the central county(ies). Adjacent counties with at least 50 percent of their population in the urbanized area are also designated central counties of the MSA. Additional "outlying counties" are included in the MSA if they meet certain requirements, such as a high degree of commuting into the central county(ies) or high population density.

are lost to development each year (American Farmland Trust 1996). Indeed, farmland in New York decreased by 66 percent from over 22 million acres in 1910 to only 7.5 million acres in 1997 . Of course, some of this acreage was marginal farmland that was re-converted to forest land during the first half of the century (Hirschl and Bills 1993). However, prime farmland now comprises an increasing percentage of farmland converted to non-agricultural uses. The rapid loss of farmland has led many counties to adopt farmland preservation programs (Nelson 1992), such as purchase of development rights (PDR) and transfer of development rights (TDR), but with limited success (Freedgood 1991). Furthermore, there is a growing awareness that conserving farmland is very difficult when farming the land is not economically viable (Heimlich and Anderson 2001).

Impermanence Syndrome

Discerning the effects of urbanization on agriculture is important for the United States as a whole, and is particularly important for dairy production in the Northeast. This is because while approximately one-third of all farms in the U.S. are located within Metropolitan Statistical Areas (MSAs), one-half of the farms in the Northeast are located in MSAs (Lapping and Pfeffer 1997). Many of the people who migrate to rural areas (within and outside of MSAs) do so to take advantage of the open spaces, water and air quality, landscape and scenic quality, and wildlife habitat (Nelson and Dueker 1990). While dairy farms are vital to the production of many of these amenities, many such in-migrants hold romanticized views of dairy farming which do not coincide with the realities of the large-scale, mass-production dairy enterprises that are becoming increasingly common (Heimlich and Anderson 2001). Thus, conflicts arise over noise, dust, odors, and other by-products of common agricultural practices (Lopez *et al.* 1988). As Pfeffer *et al.* (1999: 426) note, “While metropolitan expansion has reduced the spatial distance between the urban population and agriculture, it is not clear that the social separation between them has diminished." Also, increases in population are often accompanied by higher property tax burdens due to higher costs for public services and escalating land values (Cosgrove 1994; Lapping and Pfeffer 1997).

The negative externalities associated with urbanization can eventually lead to what Berry (1978) first called the "impermanence syndrome". He posited that encroaching urban development causes farm operators sufficient problems to make them stop investing in their operations because they perceive as imminent a high likelihood of selling their farms to developers. While certain kinds of agriculture such as roadside vegetable stands and nurseries may benefit from the urban expansion, other forms such as dairy and field crops are disproportionately affected adversely (Berry 1979). Indeed, the impermanence syndrome can even accelerate as the remaining farmers see the infrastructure of businesses and services serving agriculture decline (Heimlich and Brooks 1989).

Long and Hirschl (Long 1992; Hirschl and Long 1993) conducted a study of all of the dairy farmers in Dutchess County, NY from 1984 to 1990 to determine which variables best predicted farm exits and farm survivors. Their model included age, family difficulty, size, attitude towards farming, and perception of urbanization. Their logistic regression analysis revealed that age and family difficulty were the best indicators of farm exit, while the perception of urbanization was third, but was not statistically significant. Long and Hirschl's study suffers, however, from imprecision with regard to their variables. For example, other studies have shown that middle-age farmers have the best chance of survival, while young and old farmers are more likely to exit dairy production (Cruise 1990; Cruise and Lyson 1992), therefore age can not be treated as a continuous variable with a normal relationship to the outcome variable.

Furthermore, their study does not adjust for the fact that older farmers who plan on passing down their farms may have very different decision processes than those without family members willing to take over the farm. Finally, Long and Hirschl, as well as other scholars (e.g., Berry 1978) focus on the perception of urbanization rather than examining how objective measures of sprawl can be used to discern whether the sprawl is leading to farm disinvestment and exit. This last omission is critical in that one of the most commonly noted negative externalities of sprawl is an increase in complaints about farm activities (e.g., Berry 1978; Lopez *et al.* 1988; Heimlich and Brooks 2001). These studies do not take into account the fact that the rapid expansion in the size of livestock farms can produce so much manure and odor that even long-term residents complain. Farmers who receive complaints thus may attribute complaints to the spread of sprawl when in actuality it is their farm practices that have led to the increased friction. To compensate for this, this study includes an objective measure of population flows and land-use changes along with a measure for the perception of sprawl in order to examine the impact of sprawl on farming.

Study Rationale and Data Collection

This study is a part of a multi-university and multi-state project with the goal of understanding the changes that characterize the dairy industry in the United States. Primary data collection was funded by USDA Regional Project NE-177. An overarching goal of this project was to help dairy farm families, their communities, elected officials, support businesses, and cooperative extension manage the changes in the dairy industry. This thesis supports the overall USDA research project in particular by contributing to understanding dairy production in a location that has begun to characterize many parts of the United States: the urban fringe of a Metropolitan Statistical Area. Ontario County in the Finger Lakes region was chosen in part to represent many state-wide trends. Ontario County, which is described in detail in Chapter 3, is also one of the areas in the state in which a significant number of the dairy farm operators have been expanding their herds and industrializing. The number of dairy farms has been decreasing while the number of cows, average herd sizes, and milk production has been increasing. This representative and longitudinal case study also presents a methodological balance to the larger, purely quantitative studies being done elsewhere. Indeed, there has been a recent upswing in interest in agricultural industrialization (e.g., Sharp *et al.* 2002), but these studies often use county-level data. The results of this case study show in Chapter 3 that county-level data hides complex interactions occurring at the township level.

On-farm Panel Study

The data collected under the project include surveys of 50 dairy farms in each of 1993, 1998 and 2002. The initial list of dairy farmers came from a local New York State Cooperative Extension agent. The baseline survey conducted in 1993 included questions on farm characteristics, practices, operations and performance, perceptions and priorities, economic conditions, and non-farm employment. Contacting farmers by phone starting in the Northeastern corner of the county, the researchers moved south and west until fifty dairy farm households had agreed to participate in the study. This sampling design was chosen over random sampling to better control for social and ecological conditions (Welsh 1995). Thirteen of the farms surveyed in 1993 had exited dairy production by the time of the second round of survey interviews in 1998 and another two farmers did not participate because of health reasons or time constraints. Another three dairy farms exited dairy production from 1998 to 2002, leaving the final survey with only 32 of the original 50 farms. For this thesis, I analyze data from the 48 dairy farms that were surveyed in 1993 and either exited dairy production or participated in the subsequent surveys in 1998 and 2002.

Organization of Thesis

In this introductory chapter, I have discussed the importance of agricultural restructuring and sprawl both nationally and in New York State. Focusing on dairy production, I have shown that dairy production has been undergoing a dramatic structural transformation towards fewer, larger farms. Farms are becoming larger and are increasingly using capital and management intensive technologies and practices. The high financial costs associated with these technologies often forces farmers to expand their scale of production to capture economies of scale. The larger herd sizes also increase the need for hired labor on most farms.

I also noted some of the dominant demographic trends of the last forty years, focusing on the spread of suburban and exurban sprawl into formerly rural areas. The discussion of sprawl was coupled with its agricultural counterpart – the loss of farmland to commercial and residential development. These two processes, the structural transformation of agriculture and sprawl, supposedly exacerbate one another through the impermanence syndrome. Finally, I explained the rationale for this thesis along with its connection to the multi-state project on the structural transformation of the dairy industry. I also gave a brief description of the study site, the research methodology, and the kinds of data collected.

In Chapter 2 I expand on the research methods and analyses employed and explain in detail the concepts explored in the analysis of the dairy farm panels. I followed the logic of the treadmill of technology and impermanence syndrome hypotheses in choosing independent and outcome variables, namely dairy farm survival and the expansion of the dairy farm operation to become a very large farm. I also delineate how I operationalized each variable and how each variable is hypothesized to be related to the each other and the outcome variables.

In Chapter 3, I use secondary data on the county as well as insights from interviews conducted on community leaders to provide a portrait of the population flows affecting Ontario County. Here I focus on the relationship between population growth and land-use choices by examining township-level data on population, housing, and farmland conversion. I also give a broad sketch of the County's agriculture, focusing on the dairy sector.

In Chapter 4 I analyze the data from the panel study, providing univariate and bivariate analyses to show the manner in which dairy production in the County is consolidating and industrializing. I also show that urbanization does affect agriculture, but that the measures used to analyze these effects needs to be better specified, especially in the case of very large dairy farms. Also, the treadmill of technology hypothesis is a much better predictor of which farms will expand production than it is a predictor of which farms will exit dairy production. Finally, I conclude the thesis in Chapter 5, providing some discussion of how the treadmill of technology and impermanence syndrome hypotheses can complicate one another as well the implications of dairy restructuring for New York State.

CHAPTER 2

RESEARCH DESIGN, METHODS OF ANALYSIS, AND CONCEPTS

As described in Chapter 1, I am primarily concerned with how the structural transformation of the dairy industry interacts with sprawl at the dairy farm level. I am specifically interested in discerning whether the treadmill of technology hypothesis or impermanence syndrome hypothesis explains the agricultural transformations taking place in the dairy sector of Ontario County. These rival hypotheses offer a way to analyze the interaction of agricultural transformation and sprawl, and should help us understand whether farm consolidation and industrialization and sprawl exacerbate one another.

I explored these questions through a *longitudinal representative case study* (Yin 2003) of dairy farming in an urbanizing county in the Northeast from 1992 to 2002. The case study site, Ontario County in the Finger Lakes region, was chosen because it represents many state and region-wide trends and characteristics. Ontario County, a traditional dairy county on the edge of the expanding Rochester Metropolitan Statistical Area (MSA), was one of the areas in the state in which a significant number of the dairy farm operators have been adopting an industrial production model and expanding their herds dramatically. While Ontario County was historically rural, the Rochester MSA had spread to the point that the Northwestern township of Victor is now a suburb while other parts of the county are experiencing increased development pressure. Given the continued expansion of large-scale animal production and sprawl, this case study of dairy farming in Ontario County will likely become even more representative of these broad processes in the future.

Research Design

To examine the interacting processes of agricultural consolidation and sprawl, I employed a parallel mixed model design (Tashakkori and Teddlie 1998), collecting both quantitative and qualitative data on the County and its agricultural sector. I follow Denzin (1978) and Yin (2003) in triangulating both data sources and methods in building the longitudinal case study. To confirm that dairy production in the county is undergoing a structural transformation, I analyzed state and national agricultural census data from 1987 to 2002, focusing on dairy production. I then examined national census data from 1990 and 2000, as well as tax records, and other county and city government documents to understand the socio-economic context and to confirm that sprawl is taking place. Also, I conducted 51 informal interviews with community members from 2000 to 2001, and used my 16 site visits to conduct formal interviews with community and business leaders connected to agriculture to understand the historical significance of dairy farming to the county. These site visits and a windshield survey enabled me to drive almost every mile of road in the county to see the physical reality underlying the census data.

Collecting this array of primary qualitative and secondary quantitative data benefited me enormously in analyzing quantitative data collected through the survey interviews done on the dairy farms in 1993, 1998, and 2002. The original intent of the study was to conduct a longitudinal panel study of dairy farm characteristics and practices, but the high number of dairy farm exits made that impossible. Instead, I analyze data from the 48 dairy farmers who were surveyed in 1993 along with the 35 and 32 farms still producing milk in 1998 and 2002, respectively.[4]

[4] The larger USDA NE-177 study compensated for the dairy exits by interviewing additional farms in 1998 and 2002 so that three groups of 50 farms could be compared.

The low number of cases, especially in regards to the 1998 data precluded most sophisticated statistical analyses. I originally intended to use binary logistic regression to determine causal models for dairy farm survival and dairy farm expansion. Unfortunately, the high standard errors for many of the independent variables showed that the number of cases was too small for even binary logistic regression's extraordinary statistical flexibility to overcome.

While the dairy farm panel was not suitable for logistic regression analysis, it was appropriate for explanatory longitudinal case study analysis as described and conducted by Campbell (1975), Miles and Huberman (1994), and Yin (1994). This analytic strategy relies on theoretical propositions to predict an outcome or outcomes, and then analyzes evidence based on those propositions. By using a mode of analysis called "pattern-matching" (Yin 1994), the analyst compares an empirical pattern with a predicted one. Campbell (1975), for example, used pattern matching to show that lowering the speed limit in Connecticut was not related to an observed drop in traffic fatalities.

Univariate and Bivariate Analysis

I proceed by presenting univariate and bivariate data on the major characteristics and practices of dairy production, including the operator characteristics (age), size (cows), capital-intensity (parlor milking system), management intensity, milk production efficiency (milk produced per cow per year) and relationship to surrounding area (existence and perception of sprawl, and complaints). I present central tendency statistics (mean, median, standard deviation, and range) for continuous variables such as number of cows, while providing counts for binary variables such as the perception of sprawl.

Bivariate correlations measure the strength of the relationship between two variables, varying from 0 (random relationship) to 1 (a perfect positive linear relationship) or -1 (a perfect negative linear relationship) (Bobko 2001). Correlations are reported in terms of the amount of variance in each variable explained by the other variable. There is no causal direction inherent in correlation analysis; rather the two variables "explain" variance in each other. Bivariate correlation analysis operates under a number of assumptions, including that the relationship between the two variables is linear. Also, the distributions of the two variables should be similar, which in practice means that each variable should be normally distributed. To discern whether this assumption was met I examined the kurtosis and skewness of each variable, performing the appropriate transformation (square root, natural log, etc.) on variables that fell outside of acceptable limits for normality.

The assumption of underlying normality is especially important when determining the statistical significance of the correlations. This is not a large concern here given that the panel studies are not random samples of a larger population, and thus are not strictly appropriate for inferential analysis (Henkel 1976). That said, the use of statistical significance has become so prevalent, even in the analysis of non-random data, that I have included it here, marking the relationships that meet the standard .05 and .01 criteria for one-tailed tests. Also, given that statistical significance reflects both the strength of the relationship as well as the sample size, the relationships reported here are probably stronger than they appear due to the small number of cases.

Concepts, Hypotheses, and Operationalization of Variables

The primary objective of this study is to identify the factors that lead to dairy farm survival and expansion to larger scale to understand the interaction of agricultural transformation and sprawl. Here I delineate my conceptualization and operationalization of the dependent variables, farm survival and farm expansion, the independent variables, and their hypothesized relationships according to the "treadmill of technology" and "impermanence syndrome" hypotheses.

Dependent Variables: Dairy Farm Outcomes

Continue Dairy Farming

The most important decision facing every dairy farmer in the United States is whether to continue producing milk. Some dairy farmers are able to have a successful career and then retire, passing on their land, equipment, and livestock to their children. Their children then often continue dairy farming, maintaining both family tradition and land. Retiring dairy farmers who do not have children who want to take over the farm typically sell their equipment and livestock to other farmers. Other retiring dairy farmers decide to exit dairy production but continue less labor-intensive agriculture such as row crop production.

Some dairy farmers, however, are forced to exit dairy production, and possibly agriculture altogether, due to an assortment of reasons including illness and financial hardship. These farmers either rent or sell their land to other farmers, or they sell their land to developers. Even if such farmland is not immediately turned over to residential or commercial development, land in urbanizing areas that goes out of dairy production is more likely to be developed because there are few agricultural activities as land-intensive as dairy farming. Therefore, understanding the factors that lead to dairy farm survival is important for farmland preservation as well as for apprehending the way in which dairy production is consolidating.

Dairy farm survival for the 1993 panel was determined when the 1998 panel study was being conducted. Therefore, if a farm included in the 1993 panel was still producing milk at the time of the 1998 panel, then that dairy farm was considered to be a surviving dairy farm. Likewise, a farm in the 1998 panel that was still producing milk or had been passed down to family members by the time of the 2002 panel study was considered to be a dairy farm survivor.

Dairy farm survival is thus defined and operationalized here as a binary dependent variable where farmers who continued dairy farming or transferred their farms to family members are coded ‘1’. Following effect coding, farmers who exited dairy farming other than through family succession are coded as ‘-1’.

According to the treadmill of technology hypothesis, those farmers who adopt capital-intensive technology such as parlor-milking systems as well as advanced management techniques will produce more milk more efficiently and thus be more likely to survive. Conversely, those farmers who rely upon traditional technologies and management methods will be less likely to continue dairy farming. These technologies should thus be positively associated with dairy farm survival. The impermanence syndrome hypothesis, on the other hand, holds that farmers whose farms that are located outside of sprawl areas and do not perceive the spread of sprawl will be more likely to continue dairy farming.

Expansion to Very Large Dairy Farm

What constitutes a large or very large dairy farm has grown over time as technological advances have enabled farmers to handle more cows with less labor. Whereas “more than 200 cows” was once the largest category for dairy farms in the

USDA Census of Agriculture, the largest category is now "more than 500 cows." It should be noted that the definition of large or very large farms is to some degree regionally dependent. For example, a 400-cow farm in California would be considered a medium-sized farm, whereas a farm with the same number of cows in New York would qualify as a large farm. This is due to the environmental conditions as well as the traditional size of dairy farms in the region.

To provide consistency as well as the ability to easily compare the results of this study with studies in other locations, I decided to define very large dairy farms solely in terms of the USDA/EPA definition for "Concentrated Animal Feeding Operations" or CAFOs.[5] According to the USDA/EPA definition, a dairy farm that has more than 220 lactating dairy cows and produces liquid waste is considered to be a CAFO.

I created a binary variable with "1" representing farms with over 220 lactating dairy cows at the time of the survey. It should be noted that I did not include any other criteria in determining very large farms. Thus, while most very large dairy farms have parlor milking systems and use advanced management techniques, they are not a pre-requisite for this status, this being purely a measure of scale of production. According to the treadmill of technology hypothesis, those farms that use parlor-milking systems and advanced management techniques will produce milk more efficiently. Also, these farms are more likely to need to recoup their capital

[5] The EPA and USDA now use the concept of the 'Animal Unit' to measure the size of animal feeding operations such as dairy farms. Any farm with more than 1,000 animal units is considered to be a Concentrated Animal Feeding Operation (CAFO), and thus is subject to certain regulations. Animal units are a way to gauge the relative environmental impact of manure and runoff from the farm, with on beef cow equaling one animal unit. Mature dairy cows produce a lot more waste than most other domesticated livestock, and are given an animal unit value of 1.4, whereas sheep produce less and are considered the equivalent of 0.1 animal units. While any operation of over 1,000 animal units (700 dairy cows) is considered to be a CAFO, farms that have over 300 animal units and produce liquid waste are also considered CAFOs. Given the propensity of larger dairy farms to store liquid manure and to clean out the housing and milking facilities with water, dairy farms with over 220 dairy cows are almost always considered CAFOs.

investment in the parlor-milking system and thus need to expand their operations. According to the impermanence syndrome, those farmers located in urbanizing areas along with those farmers who perceive sprawl are more likely to disinvest from their farm. Thus, farmers located in sprawl areas and those perceiving sprawl should be much less likely to expand their operations to become very large farms.

Independent Variables

Operator Age

Age refers to the age of the principal farm operator. Age has always had a complicated relationship with farm survival and the adoption of new technology. Older farmers are obviously more likely to retire, and if they do not have someone in their families who want to take over their farms, then their farms have a higher probability of being converted to non-dairy and even non-agricultural uses. Also, given that farmers often do not have retirement plans, they view their land as providing for their post-farming life (Long 1992). This is especially true if they are surrounded by sprawl, offering the opportunity to sell their farmland to developers and thus get higher returns than renting or selling the land to another farmer. Older farmers are also more likely to suffer debilitating injuries or illnesses, and thus be forced to exit dairy production. On the other hand, older farmers are generally more skilled farmers, and are often better off financially. Carley and Fletcher (1988) found that older dairy farmers with smaller herds and relatively efficient production carried the least debt. Younger farmers, farmers with larger herds, and farmers with low rolling herd averages had higher debt ratios. Older farmers are thus more likely to have the capital and land necessary to expand their operations, but older farmers are less likely to dramatically change their operations as they approach retirement, unless they are planning on handing their farms down to family members (Hirschl and Long 1993).

Survey respondents were asked to give their age, which was then operationalized as a continuous independent variable. The treadmill of technology hypothesis does not deal directly with age as an independent variable while age is of secondary importance to the impermanence syndrome hypothesis. Nonetheless, I include it here because of its general importance. I hypothesize age to have a negative relationship with farm survival and large expansions.

Herd Size

The most basic measurement of size of a dairy farm is the number of cows in its dairy herd. Farmers were asked the number of cows on the farm five years ago, the year of the survey, and the expected number of cows five years after the study. These responses enabled me to get a general sense of the trajectory of each farm operation. Given that the surveys in 1998 and 2002 gave concrete numbers on the number of cows, though, I chose to use the actual number of cows in 5 years rather than the expected number of cows. Herd size was operationalized as a continuous independent variable. Herd size should be positively associated with capital and management-intense technology (El-Ostra and Morehard 1999).

Herd size is at the heart of the treadmill of technology hypothesis, with farmers using economies of scale to recoup their capital investments. Thus, the number of cows should be positively associated with dairy farm survival and very strongly associated with the expansion to very large dairy farm operations. On the other hand, while the impermanence syndrome hypothesis does not address farm size *per se*, I expect that farmers with larger farms would be more likely to perceive sprawl, whether they are located in an urbanizing area or not. If the impermanence syndrome hypothesis holds, then farms located in sprawl areas will have fewer cows than those located in rural areas.

Capital-intensity: Parlor milking system

Capital intensity refers to the amount of capital invested in a farm. For dairy production the presence of a parlor milking system signifies a capital-intensive operation (El-Ostra and Morehard 1999). As noted earlier, the adoption of capital-intensive production methods is central to the treadmill of technology hypothesis.
I created a binary variable based on the type of milking-system used on the farm. The use of a parlor milking system is coded as '1' while other milking systems are coded as '-1'. Increasing capital-intensity should be both positively correlated with farm survival since farmers are less likely to make such an investment prior to retirement and exiting production, and very strongly correlated with expansion to a very large farm.

Management Intensity

Management intensity is measured by the use of herd management techniques (i.e., feeding, breeding and milking technologies). Some farmers see intensive management as a way to increase production while other farmers manage their cows intensively to cut down on operating costs. Thus, some farmers see intensive herd management as part of an ever-expanding industrial production model.
Farmers were asked a number of questions regarding practices applied to their dairy herds, including whether they dip the teats in cleaning solution pre and post milking, use veterinary services regularly, balance feed rations, artificially inseminate at least 75% of their heifers, and keep production records. All of these variables were coded as binary variables coded '-1' for "No" and '1' for "Yes". Rather than present the

univariate data on each of these practices, I follow Cruise and Lyson (Cruise 1990, Cruise and Lyson 1995) in creating a multivariate scale to measure the management-intensiveness of an operation. I combined the binary practice variables into an additive scale, with reliability tests revealing acceptable standardized Crombach's alphas of 0.71 for the 1993 study and 0.73 for the 1998 panel, giving reasonable assurance that the items in the advanced management practices scale are measuring the same phenomenon. The use of advanced management techniques should increase production efficiency, increasing the amount of milk produced per cow per year.

The advanced management practices scale is an interval variable from 0 to 6. According to the treadmill of technology hypothesis, farms that employ the most recent management techniques should be expected to continue dairy farming, though the relationship to farm expansion is more ambivalent. That is because farmers can use more advanced management techniques as a way to increase production so as to not have to expand their operations. Likewise, the impermanence syndrome hypothesis does not address management intensity. Given that advanced management techniques are strongly associated with capital intensity (Welsh 1996; El-Ostra and Morehard 1999), I expect management intensity to be strongly correlated with very large expansion.

Total Milk Production and Productivity Per Cow

While the number of cows on the dairy farm may be the best measure of the size of a farm, a farmer's ability to produce milk at a profit also depends on the efficiency and productivity of the farm. Farmers were asked a number of questions regarding milk production, including the total amount milk produced in millions of pounds, and the rolling herd average, or the average amount of milk produced by a cow in a year. These responses were coded as continuous variables. Rolling herd average should be positively associated with many of the other independent variables, including the utilization of a parlor milking system and advanced management techniques. According to the treadmill of technology hypothesis, rolling herd average should also be positively associated with dairy farm survival and the expansion to a very large dairy farm.

Utilization of Industrial Mode of Production

The industrialization of agriculture is a key component of agricultural transformation. As noted by Welsh (1996) and others, agricultural industrialization is comprised of a bundle of characteristics, including the use of capital and management intensive technologies, hired labor, and farm specialization. Given that most dairy farms in both the United States and Ontario County are specialized producers I do not report individual statistics on farm specialization. Also, because the questions asked regarding labor in the 1993 and 1998 surveys were not compatible, I decided to forgo presenting individual data on dairy farm labor practices. Rather, I bundled specialization, labor practices, capital-intensity, and management-intensity to create an independent variable for dairy industrialization.

Farms that have a parlor-milking system, use at least three of the advanced management practices described previously, and hired more than one full-time employee were considered to be industrially-organized farms and were coded “1”. Those farms that did not meet these criteria were coded “-1”. This variable will obviously correlate very highly with the independent variables for parlor-milking facility and management-intensity given that they are part of its definition. Farm industrialization is central to the treadmill of technology hypothesis, which states that industrial farms are more likely to not only survive but also expand their production capabilities by adding cows. According to the impermanence syndrome hypothesis, operators of farms located in sprawl areas and those who perceive sprawl would be less likely to industrialize given the capital investment needed and poor prospects for getting a return on the investment.

Sprawl

One of the key purposes of this thesis is to discern whether the spread of sprawl is affecting dairy farm decisions in Ontario County as would be expected under the impermanence syndrome hypothesis. To that end I have included three variables that address some aspect of sprawl. These include an objective measure for sprawl, which combines changes in population, housing, number of rooms, and real tax valuation. Sprawl is defined as the spread of low density, predominantly residential growth. Given that urban sprawl is not an easily definable concept, I had to make careful decisions in regards to my scale components. Kolankiewicz and Beck (2001) note that urban sprawl is made up of population growth and land use choices. Population growth at the county level is often used by demographers to measure sprawl. The data presented in Chapter 3 shows that this is inadequate in that population growth can be highly differentiated across townships within a particular county. Indeed, every village and city in Ontario County grew less than the surrounding township.

The data on the separate measures used to create the sprawl variable are detailed in Chapter 3 where I provide the socio-economic context for Ontario County's dairy sector. For the purpose of analyzing the 1993 and 1998 panels I chose to operationalize sprawl as a binary independent variable with farms located in sprawl areas coded as "1" and farms located in areas not experiencing sprawl coded as "-1". I decided to code this as a binary variable rather than a continuous variable based on a composite of the measures detailed in Chapter 3 because many of the farms in the study farm land in more than one township. Sprawl should be positively associated with two of its supposed effects, the perception of sprawl and complaints from neighbors.

According to the impermanence syndrome hypothesis, those farms located in sprawl areas will be less likely to continue dairy farming and would be much less likely to expand their operations. On the flip side, farms located in areas not experiencing sprawl should be more likely to continue dairy production and to expand existing facilities. The treadmill of technology hypothesis does not concern itself with sprawl or its supposed effects on dairy production.

Perception of Sprawl

Given that numerous scholars have used the perception of sprawl as the trigger for the impermanence syndrome (e.g., Coughlin *et al.* 1977; Long 1992), I have included a variable measuring whether farm operators perceive the spread of residential or commercial development into their area. In 1993 farmers were asked whether urban growth had driven up land prices and whether anyone had offered to buy their farm for development. I combined these two responses to form a binary variable where '-1' refers to low development pressure and '1' refers to high development pressure. Farmers in 1998 were asked, "Is the area around your farm experiencing rapid nonfarm residential growth?" Responses were coded '-1' for 'No' and '1' for "Yes". The perception of sprawl should be strongly correlated with the independent variables for objective sprawl and complaints, and according to the impermanence syndrome hypothesis negatively correlated with farm survival and farm expansion.

Complaints About Dairy Operation

One of the key assumptions of the impermanence syndrome is that formerly urban residents who move to rural areas are not accustomed to the realities of farming and thus complain about farm odors and practices such as slow-moving tractors clogging commuter roads (Berry 1978). Respondents were asked whether they had received complaints from neighbors regarding their farm operations. Responses were coded into a binary variable with '-1' meaning they have not received any complaints, and '1' meaning they have received complaints. If the impermanence syndrome hypothesis holds, then complaints will be strongly related to both objective sprawl and the perception of sprawl, and will be negatively related with farm survival and farm expansion.

Context and Case Study

I have used this chapter to delineate the logic used in my research as well as the data sources used. I also delineated the concepts used, how I operationalized them for the panel study, and their hypothesized relationships to the two outcome variables, dairy farm survival and expansion to become a very large dairy farm. As mentioned, the analytic technique of "pattern matching" will be used to determine whether the data collected support the treadmill of technology or impermanence syndrome hypotheses. I present the socio-economic and demographic context of Ontario County as well as an overview of its agricultural sector in Chapter 3. This is then followed in Chapter 4 by the results of the on-farm panel survey.

CHAPTER 3

ONTARIO COUNTY, NY

This study was conducted in Ontario County, New York, located in the Finger Lakes region on the southeastern edge of the Rochester metropolitan area. Ontario County was chosen for this study for several reasons: dairy is its primary agricultural sector, making up 46.5% of total agricultural production; the county has been undergoing a structural transition toward larger dairy enterprises, and it is located within an urban/rural fringe and thus faces many of the developmental pressures common to the urbanizing Northeast. Indeed, data taken from the US Census shows that Ontario County is a casebook example of sprawl, with farmland being converted to non-agricultural uses at an accelerating rate in many parts of the county (Ontario County 2000).

This chapter begins with a socioeconomic and demographic description of the county before examining dairy farming. I draw on a number of secondary sources including U.S. Census and Agricultural Census data and County tax records to provide quantitative data on the County and its municipalities. I also use data gained through over fifty interviews with community residents and leaders to provide a thicker historical description of the socioeconomic and demographic processes affecting the County. The sixteen visits I made to the County to conduct these interviews enabled me to see and understand the different settlement patterns around the County.

Ontario County has experienced moderate, but highly differentiated growth over the last few decades. After delineating population and housing flows, I describe the county's physiographical characteristics pertinent to agriculture. I then detail the economic importance of dairy farming to Ontario County's community through secondary and primary data. Here I provide a thumbnail sketch of the broad agricultural production trends with emphasis on dairy production at the county level, to show the continued importance of dairy farming to the county. Agricultural trends are then juxtaposed with demographic trends at the town level to show that population and agricultural bases are changing in a variety of ways, leading to a loss of farmland.

As shown in the following analysis, the area between and south of Geneva and Canandaigua is by far the most rural and least affected by sprawl. The Northeast area from Phelps to Manchester is experiencing leapfrog development due to its proximity to Rochester, Syracuse, and the Thruway. The Northwest area from the city of Canandaigua to Victor is increasingly subject to suburban sprawl, with the town of Victor becoming a de facto suburb of Rochester. Figures 3.1 and 3.2 provide a visual representation of these demographic flows and concomitant conversion of farmland. The data used in these maps is described in further detail throughout the chapter.

Ontario County: location and demographic flows

As Figure 3.1 shows, the County straddles Cananadaigua Lake and abuts Seneca Lake. Its two largest cities, Canandaigua and Geneva, sit at the northern end of each of the respective lakes. The county covers 415,360 acres (644 sq. miles) and includes some of the best farmland in all of New York. In the last 40 years, Ontario County's population increased by 47%, a statistic representative of the county's dynamic development. Table 3.1 describes the population characteristics of the County from 1950 to 2000. The fact that the county has grown more slowly over the last two decades is somewhat deceiving in that population flows have differed significantly by township. Indeed, many rural areas actually experienced population loss during the 1980s while the county as a whole grew moderately. The largest driver of growth has been the gradual expansion of the Rochester Metropolitan Area into the

County's Northwestern townships. Improvements in transportation such as the New York State Thruway and recent renovations of Highway 322 have enabled more people to commute from greater distances. The towns of Victor and Farmington, located at the northwest corner of the county, have experienced the most intense development pressure. Victor grew by 36%, 18%, 43%, and 39%, respectively, in each decade from 1960 to 2000. From 1970 to 1980, neighboring Farmington grew by 151%; its 5,368 new residents in that period represented half of the entire county's growth.

One of the drivers of population growth in the 1990s was the expansion of manufacturing in the county. Following national trends, manufacturers began moving plants outside of Rochester's borders to take advantage of cheaper land and labor as well as weaker zoning laws. County governments, desiring to create jobs, used tax incentives to further encourage the spread of manufacturing. Indeed, interviews with County officials revealed that Ontario County municipalities have been aggressively attracting manufacturing operations. The county was successful in raising manufacturing production by 37% during the 1990s (Ontario County 2000). The rise of manufacturing southeast of Rochester is a direct result of the restructuring of the high-tech industry in the late 1980s and early 1990s. Officials and community leaders explained that many of the laid-off workers and golden-parachuted managers from the nearby Xerox and Kodak plants remained in the area. These workers in turn started small outsourcing and consulting companies. Thus, an alley of high-tech firms has emerged from Rochester to the northwestern part of Ontario County. The spread of manufacturing into urban fringe areas means that employees can increasingly choose to live in rural areas. It is not surprising, then, that population pressures have spread southward to the townships of East and West Bloomfield, Bristol, and Canandaigua.

Figure 3.1: Ontario County Change in Population and Housing

1990-2000

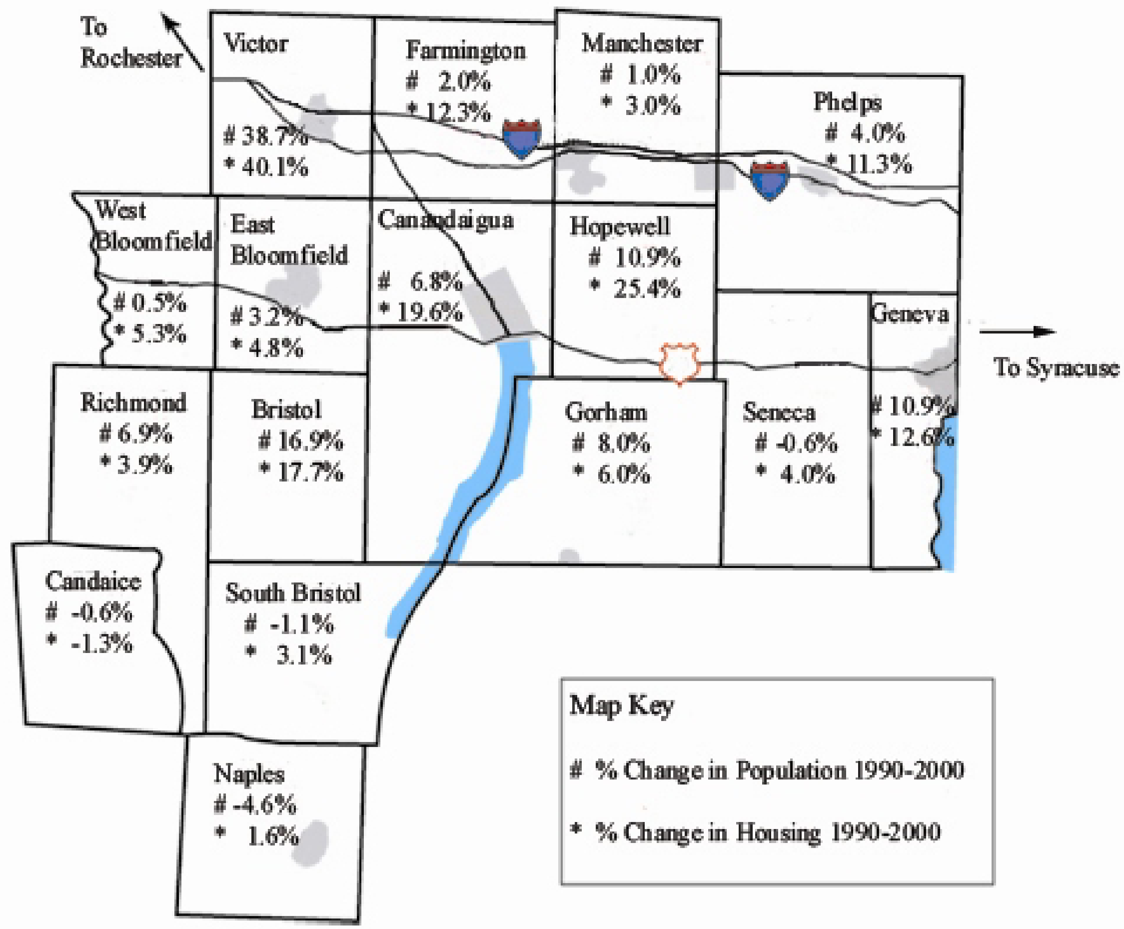
To Rochester
Victor
38.7%
* 40.1%
Farmington
2.0%
* 12.3%
Manchester
1.0%
* 3.0%
Phelps
4.0%
* 11.3%
West Bloomfield
0.5%
* 5.3%
East Bloomfield
3.2%
* 4.8%
Canandaigua
6.8%
* 19.6%
Hopewell
10.9%
* 25.4%
Geneva
10.9%
* 12.6%
To Syracuse
Richmond
6.9%
* 3.9%
Bristol
16.9%
* 17.7%
Gorham
8.0%
* 6.0%
Seneca
-0.6%
* 4.0%
Candaice
-0.6%
* -1.3%
South Bristol
-1.1%
* 3.1%
Naples
-4.6%
* 1.6%
Map Key
% Change in Population 1990-2000
* % Change in Housing 1990-2000

Figure 3.2 Ontario County Agricultural Parcels and Farmland Conversion

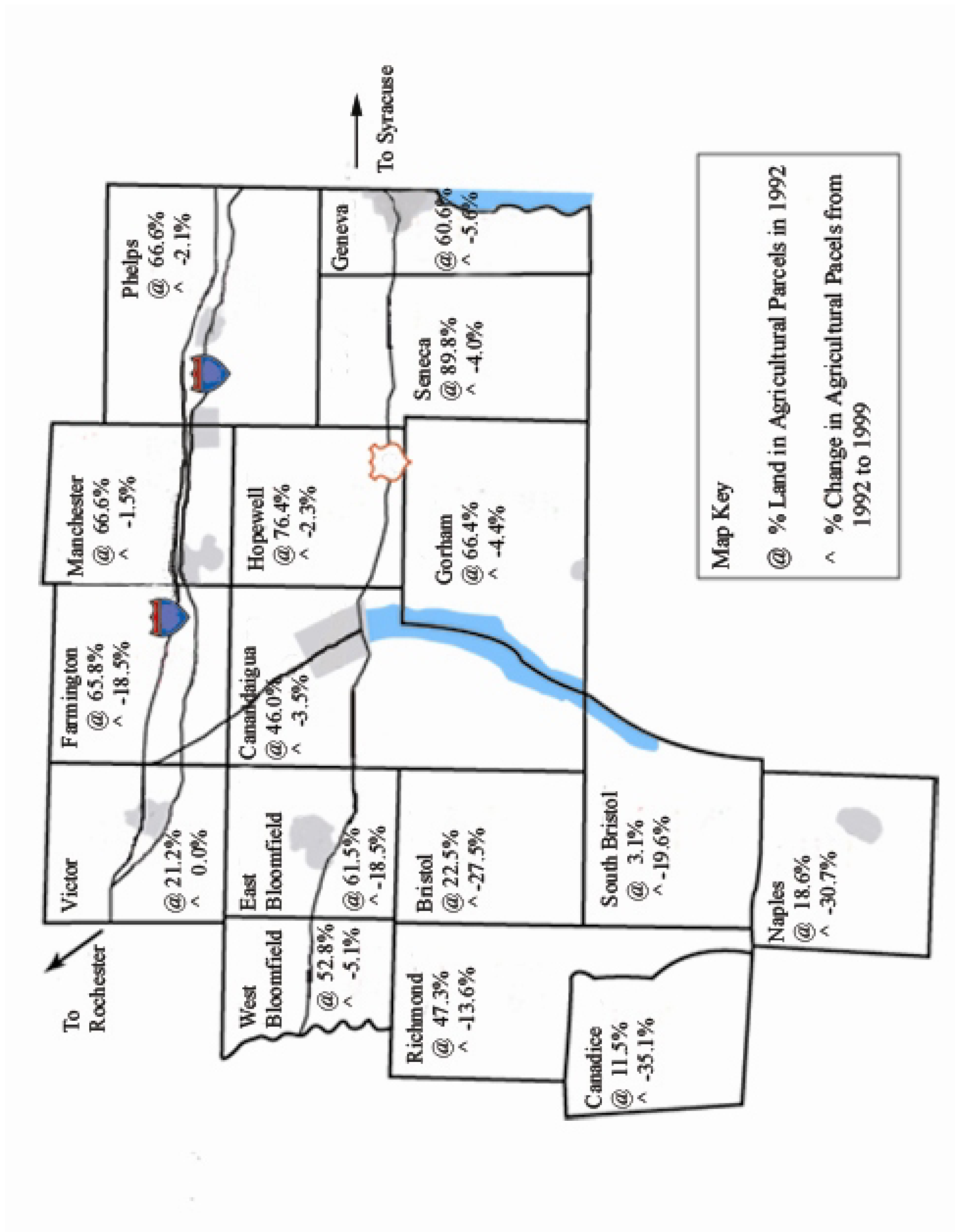
To Rochester
To Syracuse
Victor
@ 21.2%
^ 0.0%
Farmington
@ 65.8%
^ -18.5%
Manchester
@ 66.6%
^ -1.5%
Phelps
@ 66.6%
^ -2.1%
West Bloomfield
@ 52.8%
^ -5.1%
East Bloomfield
@ 61.5%
^ -18.5%
Canandaigua
@ 46.0%
^ -3.5%
Hopewell
@ 76.4%
^ -2.3%
Seneca
@ 89.8%
^ -4.0%
Geneva
Richmond
@ 47.3%
^ -13.6%
Bristol
@ 22.5%
^ -27.5%
Gorham
@ 66.4%
^ -4.4%
Canadice
@ 11.5%
^ -35.1%
South Bristol
@ 3.1%
^ -19.6%
Naples
@ 18.6%
^ -30.7%
Map Key
@ % Land in Agricultural Parcels in 1992
^ % Change in Agricultural Pacels from 1992 to 1999

Table 3.1: Population Characteristics for Ontario County 1950-2000.

Year	1950	1960	1970	1980	1990	2000
Population	60,172	68,070	78,849	88,909	95,101	100,224
Density (people/sq. mile)	93.4	105.7	122.4	138.1	147.7	155.6
% Change From Previous	-	13.1%	15.8%	12.8%	7.0%	5.4%

Source: U.S. Census Bureau

To present population and housing changes as well as farmland conversion, I have divided the various townships into 3 categories: five townships experiencing low development pressure, eight townships experiencing high development pressure, and three townships in the southwest that do not have any dairy farms. I based these categories on a number of factors, including the population density and amount of agricultural land in 1990, as well as the demographic flows and resulting changes in farmland during the 1990s. I also used the site visits and interviews to determine whether these statistics represented what was happening on the ground. For example, Gorham and Hopewell grew by 8% and 11%, respectively during the 1990s but did not experience widespread farmland conversion for two reasons. First, these counties experienced significant population loss in the 1980s, so existing housing absorbed some of the population growth. Second, the large majority of population growth came in from the in-migration of Mennonites, a religious group of predominantly farming families. Likewise, Hopewell experienced an 11% increase in population along with a 25% increase in the number of houses, but only lost 2% of its farmland. The reason for these seemingly contradictory numbers is that most of the population and housing growth took the form of a few, large trailer parks which use far less land per person than other forms of settlement. I would not have been able to understand the population numbers for Hopewell if I had not made the site visits.

Table 3.2 and Figure 3.2 are the first set of tables and maps that I use to delineate demographic flows and farmland conversion during the 1990s. Given that the tables list available statistics for villages and cities as well as townships, it is important to note that village populations are a subset of town populations. That means that the Village of Victor's 5.4% growth is included in the Town of Victor's 39% growth. Looking at population changes in both the villages and their surrounding townships shows that charting population change by township does not tell the full story of demographic flows. For example, the township of Manchester experienced a population decline of 1% during the 1990s. This is somewhat misleading, however, in terms of the effect of population changes on rural areas in the township because the villages of Manchester and Shortsville lost 8% and 11% of their populations, respectively, over the same time period. This means that while the township lost population, the areas outside of the villages actually gained population. Also, this phenomenon is not only happening in areas affected by Rochester's expansion. Indeed, every township in Ontario County grew faster than the villages and cities they encompass during the 1990s. This phenomenon is a clear indication of low-density growth commonly known as sprawl.

These shifting population flows are put into even clearer perspective when looking at the number of people who moved to a township from another county within the past decade. Given that census data only indicate the net change in the number of people, it is necessary to look at how many people were in a different location five years before the census year. Table 3.2 shows that every township had a significant number of new residents. Even towns such as Manchester and Farmington, which had relatively stable population numbers, experienced a significant number of new residents from other counties. New residents now comprise 15 to 20% of each township. Given that the 1980s witnessed similar trends, it is clear that a large segment of Ontario County residents moved to the County in the last fifteen years.

This trend is significant in that residents from non-agricultural areas may not mesh well with the more rural areas of the county (Nelson and Deuker 1998).

These indicators of increasing population growth do not portray the full effects of sprawl. As mentioned earlier, population growth took place in areas outside of villages and cities. This means that many people moved to areas that lacked sufficient housing to accommodate additional growth. Table 3.3 and Figure 3.3 chart the growth in the housing stock from 1990 to 2000. Community leaders also noted that in addition to significant increases in housing construction, average housing size in the 1990s also increased. Also, new homeowners built their bigger houses on larger tracts of land. Residents in townships close to Rochester often commented that new residents are driving up land prices, particularly undeveloped land prices.

Table 3.2: Ontario County Population Flows by Municipality

Municipality (t=township, c=city, v=village)	1990 Population	2000 Population	% change in Population 1990-2000	% of 1990 Pop. not in County in 1985	% of 2000 Pop. not in County in 1995
Low Sprawl Pressure					
Manchester (t)	9,351	9,258	-1.0	14.3	14.8
Manchester (v)	1,598	1,475	-7.7		
Shortsville (v)	1,485	1,320	-11.1		
Phelps (t)	6,749	7,017	4.0	12.6	10.5
Clifton Springs(v)	2,175	2,223	2.2		
Phelps (v)	1,978	1,969	-0.1		
Gorham (t)	3,497	3,776	8.0	15.8	17.2
Hopewell	3,016	3,341	11.0	12.7	14.3
Seneca (t)	2,747	2,731	-0.6	11.9	12.7
High Sprawl Pressure					
Bristol (t)	2,071	2,421	16.9	18.9	14.6
Canandaigua (t)	7,160	7,649	6.8	28.1	17.6
Canandaigua (c)	10,725	11,264	5.0	24.3	17.2
E. Bloomfield(t)	3,258	3,361	3.2	14.5	15.6
Bloomfield (v)	1,331	1,267	-4.8		
Farmington (t)	10,381	10,585	2.0	22.2	18.6
Geneva (t)	2,967	3,289	10.9	14.9	10.1
Geneva (c)	14,143	13,617	-3.7	28.0	23.6
Richmond (t)	3,230	3,452	6.9	19.0	19.3
Victor (t)	7,191	9,977	38.7	30.2	28.1
Victor (v)	2,308	2,433	5.4		
West Bloomfield	2,536	2,549	0.5	33.6	21.7
Non-dairy Rural					
Canadice (t)	1,857	1,846	-0.6	28.1	22.2
Naples (t)	2,559	2,441	-4.6	17.6	14.8
South Bristol (t)	1,663	1,645	-1.1	26.3	18.6

Source: US Census Data, 1990 and 2000.

Table 3.3: Housing and Aggregate Rooms

Municipality (t=town, c=city, v=village)	Houses 1990	Houses 2000	% change houses	Aggregate rooms 1990	Aggregate rooms 2000	% change rooms
Low Sprawl Pressure						
Manchester	3,705	3,815	3.0	21,504	21,753	1.2
Phelps	2,530	2,817	11.3	15,943	17,868	12.1
Gorham	1,791	1,900	6.0	10,714	11,617	1.0
Hopewell	1,070	1,342	25.4	6,515	7,934	21.8
Seneca	992	1,032	4.0	6,953	7,026	1.0
High Sprawl Pressure						
Bristol	840	989	17.7	5,341	6,380	19.5
Canandaigua(t)	2,743	3,281	19.6	17,146	20,717	20.8
Canandaigua(c)	4,717	5,066	7.4	25,613	26,872	4.9
E. Bloomfield	1,210	1,268	4.8	7,940	8,071	1.6
Farmington	3,604	4,046	12.3	21,653	24,553	13.4
Geneva (t)	1,360	1,532	12.6	8,124	9,279	14.2
Geneva (c)	5,654	5,564	-1.6	31,681	31,639	-0.1
Richmond	1,658	1,723	3.9	9,429	10,148	7.6
Victor	2,763	3,872	40.1	18,059	26,017	44.1
W. Bloomfield	996	1,049	5.3	6,043	6,563	8.6
Non-dairy rural						
Canadice	1,108	1,094	-1.3	5,993	6,048	0.9
Naples	1,095	1,112	1.6	6,957	6,921	-0.5
South Bristol	1,111	1,145	3.1	6,423	6,428	0.1

Source: US Census Data, 1990 and 2000

Agricultural Production in Ontario County

As mentioned previously, Ontario County is home to some of the best farmland in New York State. Almost 76% (311,900 acres) of the County is classified as "Important Farmland Soil" according to the USDA Natural Resources Conservation Service.[6] Half of the county is categorized as "Prime Farmland", while an additional 25% meets criteria for "Farmland of Statewide Importance", and another 1% is classified as "Unique Farmland". To put these numbers into context, only 15% of New York's land meets any of these criteria. The fertility of Ontario County's soil is significant in that any conversion of farmland to non-agricultural uses is due more to development pressure than to soil quality.

Agriculture contributes significantly to Ontario County's economy directly through product sales, input purchases, and taxes. It also benefits the tourism and development industries by maintaining the area's scenic beauty and other natural amenities. Production agriculture contributed $78 million in annual sales in 1997, and $87 million in 2002. Agriculture also supports many local businesses, spending $5.5 million on maintenance, $7.7 million on fertilizers and agricultural chemicals, $10 million on hired labor, and $10.3 million on feed in 1997 alone (1997 Census of Agriculture). Ontario County farms totaled almost $75 million production expenses in 2002.

[6] To be classified as "Important Farmland Soil" the soil must meet criteria established for three categories of farmland: "Prime Farmland", "Unique Farmland", and "Farmland of Statewide Importance". "Prime Farmland" exhibits the best combinations of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops. Prime farmland soils have the soil quality, growing season, and moisture supply necessary to economically produce sustained high yields of crops. In general, the characteristics of these soils include adequate moisture and drainage, adequate soil depth and texture, are not susceptible to erosion or flooding, and sustain high yield production with minimal fertilizer and energy requirements. "Unique farmland" produces high yields of specialty crops such as fruits and vegetables. It is characterized by good soil quality, location, topography, growing season, and moisture. "Farmland of Statewide Importance" produces fair to good yields of crops when managed according to sound agricultural practices. These farmlands are important to the state for production of food, feed, fiber, forage and oilseed crops (USDA Soil Conservation Service 1978).

Table 3.4 delineates several key indicators of farm structure, which suggest that farms in Ontario County are consolidating and industrializing. As is true for New York State as a whole, dairy represents the single largest sector of production agriculture; its $40.5 million in annual sales comprises around 47% of total agricultural sales. Dairy farming in Ontario County is also following state and national trends with farm numbers decreasing and herd sizes increasing. This trend reversed itself somewhat in the late 1990s with a large number of very small farms (less than $1,000 in sales) either starting or being included in the agricultural census for the first time (see USDA 2002 for a fuller explanation of the changing definition of what is considered a farm). Nonetheless, there is a clear trend towards a fewer number of large farms. As seen in Table 3.4, the loss of production from small dairy farms in Ontario County has been more than offset by the expansion of large farms and an increase in overall productivity. Dairy farms in the county produced almost twice as much milk in 2002 as in 1987 on 13 fewer farms. Table 3.5 shows this shift towards larger dairy farms and how the largest farms are getting very large.

There is a clear trend towards consolidating dairy production in Ontario County into a few large dairy farms. This corroborates Lyson and Geisler's (1993) finding that dairy production in the Northeast is reorganizing into an industrial model much like dairy production in the Southwest and Pacific. Given that the county's 126 dairy farms make up only 14% of the county's 896 farms, the loss of a single dairy farm has larger implications for the community than the corresponding loss of a farm in other forms of production agriculture. Indeed, the Ontario County Planning Department estimates that the closing of one 100-cow dairy farm represents an annual loss of $796,356 to the County's gross product (Ontario County 2000). Also, fewer, larger farms can not provide all of the amenities that a larger number of smaller farms provide.

Table 3.4: Agriculture in Ontario County

	1987	1992	1997	2002
Farms	930	855	850	896
Average size of farm (acres)	224.5	240.6	240.7	217.4
Dairy farms	138	123	121	126
Milk cows	10,937	11,326	14,085	15,768
Milk cows per farm	79	92	116	125
Milk Production Per Cow (lbs.)	14,600	17,000	17,700	19,600
Total Milk Produced (Mil. Lbs.)	161	204	257	311

Source: USDA Census of Agriculture 1987, 1992, 1997, and 2002

Table 3.5: Milk Cow Herd Size by Inventory: Ontario County 1987 to 2002

	1987		1992		1997		2002	
Farms with milk cow herd size:	Farms	Total Cows	Farms	Total Cows	Farms	Total Cows	Farms	Total Cows
1 to 9	23	60	12	34	6	(D)	11	(D)
10 to 19	4	48	6	85	4	44	2	(D)
20 to 49	40	1,411	32	1,124	38	1,449	38	1,493
50 to 99	49	3,502	41	2,747	25	1,701	35	2,327
100 to 199	31	3,915	26	3,396	19	2,504	20	2,714
200 to 499*	5	2,001	9	2,288	16	4,750	14	4,489
500 or more			3	1,652	5	3,373	6	4,655
Totals:	138	10,937	129	11,326	121	14,085	126	15,768

Source: USDA Census of Agriculture 1987, 1992, 1997, and 2002
* "200 or more cows" was the largest category until "500 or more cows" was created with the 1992 census.
(D) = Withheld by Census to avoid disclosing data for individual farms.

Sprawl Plus Farm Consolidation Equals Farmland Conversion

Population increases in formerly rural areas of Ontario County have combined with declining farm numbers to produce a significant trend of farmland conversion. Most of this farmland has been converted into residential housing. Table 2.10 delineates the amount and loss of farmland along with population growth by township. Again, the population numbers do not represent the full scale of population growth in rural areas given that villages declined or grew more slowly than their surrounding townships. The agricultural land amounts presented in Table 3.7 are derived from agricultural parcel data. This is significant in that agricultural parcels are intended to help keep farmland in agricultural production. Also, just as population numbers present only the net change in population, farmland conversion numbers show the net change in land used for agricultural purposes. Land is brought into and taken out of agricultural production depending on a number of factors, including commodity prices, subsidy payments, and weather conditions. Once land is developed for industrial, residential, or commercial purposes, however, it is almost impossible to convert it back into agricultural land.

Despite the economic importance of agriculture to Ontario County, agricultural land is being converted to other uses due to powerful developmental pressures emanating from the Rochester metropolitan area. While the transformation of agricultural land into residential or commercial uses has been occurring for a long time, mounting evidence suggests that this process is accelerating, especially in the northern part of the county. Hirschl and Bills conducted a study of farmland loss on 52 New York counties from 1950-1987, finding that Ontario County had an average annual farmland loss of 0.9% over this period (Hirschl and Bills 1996). This loss is to be expected given the significant population growth over the period.

While the primary reason for preserving farmland may be to ensure that the area remains an attractive vacation spot and place to live, there are also fiscal considerations. Study after study has shown that agriculture contributes more in taxes than it requires in services. Property taxes affect agriculture disproportionately due to large land holdings, with the average Ontario County farmer paying 43% of his or her net income to property taxes (New York State Advisory on Agriculture 1996). Also, agricultural land requires fewer public services (i.e., roads, fire departments, sewer and water lines) than other land uses, such as residential or industrial. This discrepancy is observed in a study carried out in nearby Onondaga County. The Onondaga County Farmland Protection Board found that converting 100 acres of farmland into twenty, 5-acre residential plots led to a net loss of $32,800 due to the additional services required (Onondaga County 1997).

Ontario County residents have come to recognize the loss of farmland as a problem. Residents and community leaders realize that Ontario County's tourism revenue is based in part on its rural amenities such as open spaces. Farmland is central to these amenities. The large influx of people into previously rural areas around Canandaigua, along with the improvements to Rt. 332, spurred the Town of Canandaigua to enlist a consulting firm to craft a comprehensive plan for the town's development. Saratoga Associates conducted interviews and focus groups with a variety of town residents and leaders. The comprehensive plan includes a recommendation to preserve farmland by concentrating residential and commercial development in a few areas (Saratoga 2002). The plan also calls for the purchase of development rights to ensure that if a farm exits production its land is not developed. However, it remains to be seen how effective these measures will be at preserving farmland given the rapid decline in farm numbers.

Table 3.6: Population Growth and Farmland Loss in Ontario County

Town	Total Acreage	Farmland Acreage 1992	Farmland Acreage 1999	% Farmland / Total Acreage 1992	% Change Farmland Acreage 1992-99	% Change Pop. 1990-2000
Low Sprawl Pressure						
Manchester	22,647	15,091	14,863	66.6	-1.5	-1.0
Phelps	40,588	27,049	26,480	66.6	-2.1	4.0
Gorham	33,815	22,453	21,464	66.4	-4.4	8.0
Hopewell	22,849	17,464	17,069	76.4	-2.3	11.0
Seneca	32,140	28,872	27,708	89.8	-4.0	-0.6
High Sprawl Pressure						
Bristol	23,349	5,251	3,808	22.5	-27.5	16.9
Canandaigua	40,120	18,452	17,799	46.0	-3.5	6.8
East Bloomfield	20,452	12,587	10,232	61.5	-18.7	3.2
Farmington	25,252	16,627	14,037	65.8	-18.5	2.0
Geneva	12,361	7,492	7,076	60.6	-5.6	10.9
Richmond	28,352	13,416	11,589	47.3	-13.6	6.9
Victor	22,190	4,706	4,717	21.2	0.0	38.7
W. Bloomfield	16,239	8,576	8,136	52.8	-5.1	0.5
Non-dairy rural						
Canadice	20,569	2,360	1,532	11.5	-35.1	-0.6
Naples	24,770	4,618	3,199	18.6	-30.7	-4.6
South Bristol	26,928	2,362	1,900	8.8	-19.6	-1.0
Ontario County	412,711	207,376	191,609	50.2	-7.6	5.4

Source: N.Y. Real Property Data; Ontario County 2000

In conclusion, this chapter has provided a thumbnail sketch of the major demographic and socio-economic forces at play in Ontario County as well as the changes affecting dairy production in the county. The growth of suburban communities in the Northwestern townships has started to spread along the county's northern border as well as towards Canandaigua. As industrial and residential development encroaches upon the more rural areas of the county, developers and new residents will be in increasing contact with dairy production. Dairy production, for its part, is moving steadily towards a fewer, larger farms. The data presented here thus show that Ontario County and its dairy farm population are experiencing the basic characteristics necessary to test whether the interaction of farm industrialization and sprawl are following the patterns predicted by the treadmill of technology and impermanence syndrome hypotheses, respectively. This sketch of Ontario County provides the backdrop for the analysis in Chapter 4 as well as the discussion chapter.

CHAPTER 4

DAIRY FARM SURVEYS: RESULTS AND ANALYSIS

In this chapter I present the results of the survey interviews conducted on 48 dairy farms in the county in 1993, with subsequent interviews taking place in 1998 and 2002. These surveys covered a variety of topics, including general characteristics related to dairy production, the relationship of the farm to surrounding communities, and future plans. Of the 48 farmers initially interviewed in 1993, only 35 were still shipping milk in 1998, with 32 surviving to ship milk through the 2002 survey. Clear patterns are evident when examining the two panel studies in relation to the treadmill of technology and impermanence syndrome hypotheses.

I proceed by first summarizing the two rival hypotheses along with the patterns they predict. I then present the 1993 survey results, providing univariate and bivariate statistics for the group as a whole as well as providing descriptive statistics according to the outcome variables. I note where the 1993 data supports and contradicts the hypothesized outcomes according to the rival hypotheses. I then analyze the 1998 survey results in the same manner, pointing out similarities and differences between the 1993 and 1998 results. Given that the farms included in the 1998 survey are by definition the survivors from 1993, they are expected to be more successful than their average 1993 counterparts. I conclude the chapter by analyzing the data in terms of the patterns predicted by the rival hypotheses.

Treadmill of Technology and Impermanence Syndrome

The treadmill of technology and impermanence syndrome hypotheses offer two rival explanations as to why farms continue dairy farming and expand production. The treadmill of technology hypothesis holds that larger farms are more likely to adopt the most recent technologies and thus are able to produce more efficiently. These farms are thus are more likely to continue farming. These farms are also more likely to expand production, in part because they usually must pay for their investments in the new technology. Thus, for the treadmill of technology hypothesis the most important factors determining the survival and expansion of a farm are its initial size and adoption of advanced technology and management methods. In short, those farms whose operators adopt the new labor saving and output enhancing technologies of agricultural industrialization are more likely to survive and expand than those that do not. The impermanence syndrome hypothesis on the other hand is more concerned with off-farm factors and is formulated in negative rather than positive terms. That is, operators of farms that are located in urbanizing areas are less likely to invest in new technology and are less likely to survive. The data presented below will be analyzed to determine whether it fits the pattern predicted by the treadmill of technology or impermanence syndrome hypotheses.

Tables 4.1 and 4.2 present the basic on-farm characteristics as well as the sprawl variables for the 48 farms surveyed in 1993. When compared with data from the 1992 USDA Census the farmers in the 1993 survey were younger than the average farmer in the county (45 years old compared to 52). Also, farms surveyed in 1993 were larger than the average Ontario County dairy farm, milking an average of 140 cows compared to the county average of 92 cows. These farmers were also more efficient milk producers, getting 19,400 pounds of milk per cow per year, substantially more than the 17,000 pounds produced on the average Ontario County dairy farm.

Table 4.1: 1993 Dairy Farm Panel: Basic Farm Characteristics (N=48)

Variable	Mean	Median	Std. Dev.	Range
Operator Age	44.6	44	10.4	26 – 64
Herd Size	140.4	115	115.3	19-639
Management Scale	4.8	5	1.5	0-6
Milk produced (mil. lb.)	2.55	2.0	2.4	0.4 – 14.6
Rolling herd avg. (lb. milk)	19,400	19,437	2,497	14,000-24,000

Table 4.2: 1993 Dairy Farm Panel: Industrialization, Sprawl, and Outcome Variables (N=48)

Variable	No	Yes
Parlor	18	30
Industrial Model	24	24
Located in a sprawl area	29	19
Perceive sprawl	27	21
Received complaints	38	10
Continue dairy farming	13	35
Expansion to very large farm	37	11

These differences suggest that the farms included in the 1993 survey were more industrialized than the average county farm of that time. Indeed, 30 of the 48 farms already utilized a parlor-milking system, and the median farm surveyed used 5 of the 6 advanced management techniques discussed. Indeed, half of the farms met all of the requirements for what I call an industrially-organized farm (i.e., are specialized producers, and employ a parlor milking system, at least 3 management techniques, and more than one hired laborer).

Given the large size of the farms and their industrial orientation, the treadmill of technology hypothesis suggests that the farms surveyed in 1993 should on average be very successful, with most of them expanding their production. Nonetheless, only 35, or 73% of the farms were still dairy farming five years later when the 1998 survey was conducted. This is obviously a large number of farm exits over a short period of time. If the impermanence syndrome hypothesis is correct, this large number of farm exits may be due to the fact that parts of the county were urbanizing. Indeed, 19 or 40% of the farms were located in are townships experiencing high development pressure and 21 or 44% of the farmers reported perceiving this urban development. Somewhat surprisingly only 10 farmers, or 21%, received complaints about their dairy operation, one of the key indicators of resident-farmer tension.

Examining the correlation matrix presented in Table 4.3 shows a number of interesting points pertinent to the treadmill of technology and impermanence syndrome hypotheses. First, age was not strongly correlated with any of the other variables. Second, as expected, the utilization of a parlor-milking was strongly correlated with the number of cows, management practices, and (by definition) the adoption of an industrial mode of production. Surprisingly, though, neither utilizing a parlor system nor adopting an overall industrial model ensured high productivity. This, along with the high correlation of management techniques and rolling herd average shows that smaller farms can be very efficient milk producers without investing in parlor systems or hiring non-family labor. This may explain why rolling herd average had the strongest positive correlation with continuing dairy farming. Though this runs somewhat counter to the treadmill of technology hypothesis, the correlations for very large dairy farming are exactly in line with the hypothesis. Quite simply, larger farms and those adopting an industrial mode of production were more likely to be milking more than 220 cows in 1998.

The correlation matrix for the 1993 dairy farm survey also provides some support for the impermanence syndrome hypothesis. First, all three indicators for sprawl (objective sprawl, perception of sprawl, and complaints) were positively and significantly correlated with one another. Of these three, the perception of sprawl tends to have the strongest correlations. Furthermore, the perception of sprawl has a significant and strongly negative relationship to continuing dairy farming with a somewhat weaker negative association with large dairy farming. Interestingly, objective sprawl and complaints also have negative relationships with the outcome variables, but these associations are much weaker, with only complaints and continuing dairy farming having a statistically significant relationship. Nonetheless, the bivariate correlations for the 1993 survey support the overall thrust of the impermanence syndrome hypothesis.

Table 4.3: 1993 Dairy Farm Panel: Correlations

	Operator Age	Herd Size	Parlor	Mgmt Scale	Rolling Herd Avg.	Indus. Mode	Sprawl	Perceive sprawl	Com-plaints	Cont. Dairy	Very Large Farm
Operator Age	1.00										
Herd Size	.16	1.00									
Parlor	.15	.52**	1.00								
Management Scale	-.23	.30**	.24*	1.00							
Rolling Herd Average	-.17	.14	.04	.47**	1.00						
Industrial Mode	.05	.51**	.81**	.39**	.19	1.00					
Sprawl	.04	-.18	-.02	.04	.01	-.04	1.00				
Perceive Sprawl	-.03	-.20	-.01	-.20	-.22	-.09	.43**	1.00			
Complaints	-.19	-.14	.06	.10	.21	.00	.25*	.36**	1.00		
Continue Dairy	.13	.22	.18	.15	.26*	.23*	-.14	-.53*	-.33*	1.00	
Very Large Farm	-.04	.62**	.44**	.22	.24	.55**	-.20	-.26*	-.16	.33*	1.00

* Correlation is significant at the 0.05 level; ** at the 0.01 level (both 1-tailed).

Summarizing the findings of the 1993 survey according to the outcome variables provides further insight into the efficacy of the rival hypotheses in understanding agricultural transformation in Ontario County. Table 4.4 shows why age had such a weak relationship to the independent and outcome variables. The thirteen farmers who exited production were quite close in age (42.4) to the 24 farmers that continued farming small and medium farms (45.4) as well as the eleven farmers that were managing large dairy farms by 1998 (45.4). Also, while there was a large disparity in the size of those farms that were very large dairy farms in 1998, the difference between those that exited dairy production and those that continued as small or medium dairy farms was not very large (99.5 to 102.7). Furthermore, over half of the farms that exited production were utilizing a parlor in 1993, while half of the farms who continued as small or medium dairy farms were utilizing parlor systems in 1993. Not surprisingly, all of the farms who were very large farms in 1998 were already utilizing parlor systems in 1993. The biggest on-farm difference between the three groups was their use of advanced management techniques and subsequent differences in milk production. The exiters used fewer management techniques on average (4.4) than those that continued farming (4.7 and 5.5 for those that became large farms). This explains in part why the exiters produced over 1,000 pounds less milk per cow than the farms that continued, and over 2,000 pounds less milk per cow than the farms that were very large farms by 1998.

Table 4.4: 1993 Dairy Farm Panel: Characteristics by Outcome (N=48)

	Exited Dairy Production by 1998 (N=13)	Continued Same Scale of Dairy Farming in 1998 (N=24)	Very Large Dairy Farm by 1998 (N=11)
Age	42.4	45.4	45.4
Herd Size (1993)	99.5	102.7	270.9
Parlor	7 / 13	12 / 24	11 / 11
Management scale	4.4	4.7	5.5
Rolling herd avg. (lbs. milk)	18,341	19,470	20,484
Industrial model	4 / 13	9 / 24	11 / 11
Sprawl	7 / 13	9 / 24	2 / 11
Perceive sprawl	11 / 13	7 / 24	2 / 11
Received complaints	3 / 13	1 / 24	6 / 11

Delineating the farms according to outcome variables also gives insight into relationship of sprawl to farm consolidation. Over half of the farm exiters were located in areas experiencing high development pressure, and almost all of these farmers perceived development pressure. This is despite the fact that less than a quarter of the exiting farmers had received any complaints from their neighbors about their farm operations. The farmers who continued farming as small or medium dairy farms were more likely to be located in areas not experiencing development pressure and were even less likely to perceive sprawl. This may be due in part to the fact that only one of the 24 farms in this group had received complaints from neighbors. Less than a fifth of the farms that were very large farms in 1998 were located in sprawl areas, with the same number perceiving sprawl. This suggests that farmers located in more rural areas were more likely to expand their production. Interestingly, over half of the very large farms had received complaints, a much higher percentage than the other groups. This suggests that complaints may be more about the size and practices of the farm rather than the location. I will discuss the significance of these findings in more detail after examining the results from the survey of those farmers still producing milk in 1998.

Tables 4.5 and 4.6 provide the basic characteristics for the farms surveyed in 1998. As expected, the farmers in the 1998 panel were around five years older than those in the 1993 panel, but they were younger than the average farmer in Ontario County at the time (49 years old to 52). Also, the farmers surveyed in 1998 were significantly larger than those surveyed in 1993 as well as larger than the average dairy farmer in the County in 1997. This was due in part to the fact that many of the farmers in the 1998 group expanded their herds significantly over the intervening five years. Also, while the average dairy farm in the county increased in size, the in-migration of Mennonite farmers lowered the average herd size for the county. The high average for the 1998 group is also due to the fact that the largest farms became very, very large, with the largest farm in the group managing over one thousand cows, over 7% of all the dairy cows in the county. That farm was not alone, however. Seven farms surveyed in 1998 had over 300 cows while three had over 500.

The farms surveyed in 1998 were not only bigger, they were also more efficient. More than two out of every three of the farms surveyed utilized a parlor-milking system and met all of the criteria necessary to be classified as employing an industrial mode of production. They used an average of 5.2 of the 6 management techniques discussed in chapter 2 in producing almost 21,000 pounds of milk per cow per year. This is a significant increase from the 19,400 pounds per cow produced by the group surveyed in 1993, and a great deal more than the 17,700 pounds per cow produced by the average dairy farmer in the county.

Given their size and productivity, one would expect most of the farms surveyed in 1998 to continue dairy farming. Nonetheless, 3 of the 35 farmers were no longer dairy farming by the time of the 2002 survey. While this is a far lower number and percentage of farmers than were lost from 1993 to 1998, the exit of almost 8% of farms over a four year period does not bode well for dairy farming in the county. Also, somewhat surprisingly, only 13 of the 32 farmers could be characterized as very large dairy farms in 2002. That is, only 13 of the farms surveyed were milking more than 220 cows. In other words, only 2 of the 24 farms that were not already very large farms by 1998 expanded their farms between 1998 and 2002. This, along with the greatly increased average farm size suggests that while most farms did not expand substantially, those that did expanded far beyond the scale of dairy farming traditionally seen in the county.

The relationship of the dairy farms in the 1998 survey to the surrounding community was similar to what was reported in the 1993 survey. Since many of the farmers who exited dairy production by 1998 were located in urbanizing areas, a smaller percentage of farms were located in areas experiencing sprawl. Around one third of the farms were located in areas experiencing development pressure while over one third of the farmers perceived this pressure. There was an increase, however, in the relative number of complaints from neighbors, with over a quarter of the farmers receiving such complaints. I will discuss the implications of these complaints for the impermanence syndrome hypothesis after examining the bivariate correlations for the 1998 survey. I turn now to an analysis of age.

Table 4.5: 1998 Dairy Farm Panel: Operator Age and Farm Value (N=35)

Variable	Mean	Median	Std. Dev.	Range
Operator Age	49.3	49	10.9	34 – 73
Herd Size	220.2	150	202.4	18-1047
Management Scale	5.2	6	1.2	2-6
Milk produced (mil. lb.)	4.37	2.9	4.64	0.2 – 24.0
Rolling herd avg. (lb.)	20,989	21,000	3,244	14,000 – 27,500

Table 4.6: 1998 Dairy Farm panel: Industrialization, Sprawl, and Outcome Variables (N=35)

Variable	No	Yes
Parlor	10	25
Industrial Model	10	25
Located in a sprawl area	24	11
Perceive sprawl	23	12
Received complaints	24	9
Continue dairy farming	3	32
Expansion to very large farm	22	13

One of the most striking aspects of the correlation matrix for the 1998 survey is the numerous significant and strong correlations with age. Whereas in the 1993 survey age did not correlate strongly with any variables, in 1998 age was strongly and negatively correlated with almost every variable, especially those concerned with dairy farm practices. It is clear from these correlations that younger farmers are the ones who invested in parlor milking facilities, expanded cow herds, and adopted management practices. Interestingly, while older farmers appeared much less likely to be either be managing a large herd or expanding their operations by 2002, there was not a strong correlation between age and continuing dairy farming. Also, in terms of the impermanence syndrome, it is interesting that age is strongly correlated with both sprawl and perception of sprawl, but in opposite directions. This is due to several factors, the most salient of which are the lack of association between sprawl and its supposed effects (perception of sprawl and complaints), as well as the strong relationship between size and complaints. These relationships will be discussed in more detail below.

In terms of the treadmill of technology hypothesis, the 1998 survey shows a tighter bundling of industrial production and large herd sizes. Also, the fact that herd average is again correlated strongly with management practices but not with parlor milking facilities suggests that some farmers are choosing to produce as efficiently as possible rather than expand production. Also, at this particular stage having a milking parlor may not be the key variable in explaining productivity. This may explain why the variables that should predict farm survival according to the treadmill of technology hypothesis do not correlate strongly with those farms that were still producing milk in 2002. The hypothesis holds up very well, though, in terms of the high correlations between herd size, an industrial mode of production, and very large farms.

The 1998 survey also produces some interesting results for the impermanence syndrome hypothesis. Unlike in the 1993 survey, objective sprawl, the perception of sprawl, and complaints are not strongly correlated with each other. Also, while the perception of sprawl was strongly correlated with the outcome variables in the 1993 survey, it is not strongly correlated with either of the outcome variables in the 1998 survey. The measure for objective sprawl does, however, have a strong, negative correlation with continuing dairy farming. Complaints, on the other hand, have a strong, positive correlation with very large dairy farms. This suggests yet again that complaints have more to do with the size of a dairy farm than with its location. Also, it does not seem that complaints are discouraging farmers from having very large farms.

Breaking the results from the 1998 survey down by outcome variables reveals even more about the factors that led to farm survival and expansion. As was noted during the discussion of the correlation matrix, age was a somewhat surprising variable. The group of farmers that exited production was actually younger than the farmers who continued to operate small to medium sized dairy farms. As was expected, though, the farmers who were managing very large herds by 2002 were substantially younger than the other farmers in the survey. Also surprising was the fact that two out of the three farmers that exited production were utilizing parlor systems and an industrial mode of production. These farms were also larger on average than the farms who continued producing as small to medium sized-farms. One on-farm factor for these farms’ exit could be that they used fewer management techniques than the other two groups (4.3 to 4.9 and 5.8, respectively).

Table 4.7: 1998 Dairy Farm Panel: Correlations

	Operator Age	Herd Size	Parlor	Mgmt Scale	Rolling Herd Avg.	Indus. Mode	Sprawl	Perceive sprawl	Com-plaints	Cont. Dairy	Very Large Farm
Operator Age	1.00										
Herd Size	-.42**	1.00									
Parlor	-.32*	.47**	1.00								
Management Scale	-.51**	.39*	.38*	1.00							
Rolling Herd Average	-.39*	.46**	.16	.44**	1.00						
Industrial Mode	-.41**	.49**	.86**	.49**	.24	1.00					
Sprawl	.31*	-.22	.16	-.17	-.16	.16	1.00				
Perceive Sprawl	-.41*	-.02	.19	.24	.29*	.32*	.16	1.00			
Complaints	-.42*	.54**	.23	.29*	.33*	.37*	.02	.26	1.00		
Continue Dairy	-.04	.14	.03	.23	.21	.03	-.45**	-.21	-.05	1.00	
Very Large Farm	-.32*	.70**	.49**	.38*	.49**	.49**	-.14	-.06	.36*	.24	1.00

* Correlation is significant at the 0.05 level; ** at the 0.01 level (both 1-tailed).

Table 4.8: 1998 Dairy Farm Panel: Characteristics by Outcome (N = 35)

Variable	Exited Dairy Production by 2002 (N=3)	Continued Same Scale of Dairy Farming in 2002 (N=19)	Very Large Dairy Farm by 2002 (N=13)
Age	50.7	52.2	44.9
Herd Size (1998)	131.0	110.4	401.2
Parlor	2 / 3	10 / 19	13 / 13
Management scale	4.3	4.9	5.8
Rolling herd avg. (lbs. milk)	18,835	19,968	22,977
Industrial model	2 / 3	5 / 19	13 / 13
Sprawl	3 / 3	5 / 19	3 / 13
Perceive sprawl	2 / 3	6 / 19	4 / 13
Received complaints	1 / 3	2 / 19	6 / 13

This difference could explain why those three farms were much less efficient milk producers, trailing the other two groups by 1,133 and 4,142 pounds of milk per cow, respectively. That said, those three were still more efficient producers than the average dairy farm in the county that year by over 1,100 pounds of milk per cow. One thing that is very clear from these results, though, is that the largest producers are much, much larger and can achieve higher levels of production per cow than other farms.

Breaking the farms surveyed in 1998 into groups by the outcome variables also produces insights into the impermanence syndrome hypothesis. While all of the farmers who exited production by 2002 were located in areas experiencing sprawl, only two of the three farmers were aware of this development pressure. Furthermore, only one of the three had received complaints about his dairy operations. Six of the farmers who continued dairy farming as small to medium sized farms perceived sprawl, though only two of these farmers received any complaints. Finally, while less than a quarter of the very large dairy farms were located in areas experiencing sprawl, almost half of them had received complaints about their dairy operation. This helps explain why complaints were strongly correlated with herd size rather than with sprawl or the perception of sprawl.

Analysis

The data from the 1993 and 1998 dairy farm surveys provides interesting, if somewhat contradictory, insight into the efficacy of the treadmill of technology and impermanence syndrome hypotheses in explaining agricultural transformation in Ontario County. There is no question that the larger farms in the county are adopting an industrial mode of production, with some of them expanding their herd sizes well beyond anything the county has seen before. These farms fit the pattern predicted by the treadmill of technology hypothesis, invariably utilizing parlor milking facilities, hired labor, and numerous advanced management techniques. As such, the treadmill of technology hypothesis does a very good job of explaining which farms will expand their operations.

The treadmill of technology hypothesis is not as useful, however, for predicting which farmers will exit production. Indeed, both surveys contained farms that utilized parlor milking facilities while adopting an industrial mode of production but yet still exited dairy production before the subsequent survey five years later. Given that 27% of the farms from the first survey and 8% of the farms from the second survey were not in dairy farming five years later, this is a serious omission. Needless to say, understanding why over 30% of farmers in a given group exit dairy production over a ten year period should be an urgent task for scholars and policy-makers alike. This is especially true given that the other variable attributed with leading to farm exit, age, was not a significant factor in exits in either survey.
These surveys provide even more interesting insight into the efficacy of the impermanence syndrome hypothesis. The fact that perception of sprawl was a strong indicator of farm exit in the 1993 survey, while objective sprawl was a better indicator in the second survey suggests that scholars must pay special attention to how they design studies aimed at testing the impermanence syndrome hypothesis. Indeed, the results for the two surveys show two different patterns, with the perception of sprawl leading to farm exit in the first survey and actual sprawl being a better predictor in the second. These findings suggest that the impermanence syndrome hypothesis is taken as a truism by policymakers and scholars despite the evidence being less than solid. Scholars must take extra precaution in determining what are the key independent and dependant variables in such studies. As this study shows, objective measures of sprawl such as population and housing changes do not automatically match with

farmer perceptions of development pressure. Furthermore, one of the key indicators of sprawl used in previous studies, complaints from neighbors, may have more to do with the expansion of farm operations than with the changing rural landscape. Also, this study shows that farmers who receive complaints are not necessarily going to change their production methods, especially given that elements of industrial production like large quantities of liquid manure are not easily avoided.

CHAPTER 5

DISCUSSION AND CONCLUSION

In this thesis I have examined dairy farming in Ontario County, New York to better understand the interaction of agricultural transformation and urbanization. By focusing on dairy farming in an urbanizing county in the Northeast, I hope to contribute to discussions concerning agricultural industrialization and consolidation as well as the effects of urbanization on farms. As discussed in Chapter 1 these issues are important not only for farmers and related businesses but also for communities that are concerned with the rapid conversion of farmland to non-agricultural uses. Also, while this study is a representative case study of dairy farming in a particular location, some of its results have much broader implications. That is because every state has dairy farmers and farmland conversion issues. Also, several states have witnessed steep declines in small and medium-sized farms with a concomitant rise in very large farms. In the case presented here, the three largest dairy farmers included in the 1998 survey represented 15% of all the cows in the Ontario County that year. These kinds of farms are becoming increasingly common in traditional dairy areas as well as areas new to dairy farming.

I used a longitudinal representative case study approach to discern the efficacy and applicability of two rival hypotheses for the survival and expansion of individual dairy farms, namely the treadmill of technology hypothesis and impermanence syndrome hypothesis. By using that analytic technique of pattern matching, I have been able to explicate the patterns predicted by these hypotheses and then compare the empirical results with those patterns. I chose this approach in part because the data available enabled a thicker description of the county and its dairy sector over the course of the 1990s. Also, a case study approach allows for the triangulation of different data sources and methodologies, including archival and secondary quantitative data as well as primary qualitative and quantitative data. Also, due to the large number of farm exits from 1993 when the first survey-interviews were conducted to 1998 when the second round was conducted, more complex statistical analyses did not produce statistically significant results. The fact that the surveys were not random samples also made inferential analysis inappropriate. I compensated for the lack of statistical sophistication by providing detail that can only be gained through numerous site visits and interviews with community residents and leaders.

Ontario County proved to be an ideal location for this representative case study because it has traditionally been a dairy county, its dairy sector has been shifting towards larger, more industrially-organized farms, and it has been experiencing urban development pressures emanating from the Rochester metropolitan area. While Ontario County grew moderately over the 1990s, the growth was highly differentiated, with some townships growing dramatically. This uneven growth has had consequences for both farmers and farmland in the county. Namely, some of the townships closest to Rochester lost almost a fifth of their agricultural parcels from 1992 to 1999.

This uneven urban development presented particular methodological issues in terms of the impermanence syndrome hypothesis. As noted in the introduction, previous studies of farmland loss and the impermanence syndrome have been conducted at the state or national level, with counties as the unit of analysis. The data presented in Chapter 3 shows that there can be significant differences in population changes and farmland changes within a particular county. This is especially true for counties located in or on the edge of metropolitan areas. Indeed, the Ontario County case shows that a township's location relative to the central core of an MSA as well as smaller cities is crucial in how much urban development pressure it experiences.

The analysis presented in the case study also questions the conceptual and methodological precision of previous studies of the impermanence syndrome. As noted in Chapters 2 and 4, many studies have used the perception of sprawl as the primary independent variable. Other studies, particularly those focused on farmland conversion, have assumed that the negative externalities associated with sprawl (i.e., complaints from neighbors) are produced by the in-migration of formerly urban, non-farming residents. My thesis questions both of these assumptions. First, the data presented from the 1993 and 1998 on-farm surveys shows that the perception of sprawl does not always match objective measures of urban growth. This is not to say that the perception of sprawl is not an important indicator. Indeed, the results from the 1993 survey showed a strong association between farmers perceiving sprawl and exiting dairy production. Rather, measures for perceiving sprawl need to be balanced with objective measures such as the ones included here (i.e., change in population and housing).

Second, results from the surveys show that complaints from neighbors were less associated with sprawl than previously assumed. Instead of stemming from the arrival of formerly urban residents, complaints are often due to factors associated with farm expansion. Complaints in the 1998 survey were much more strongly associated with the size of the farm than with sprawl. Several of the farmers who had received complaints reported that they did not perceive sprawl. These farms also tended to be the largest, which means that the increasing size of dairy farms in the area could lead to more farmer-resident tension. Also, given that all of the large farms that received complaints in 1998 became even bigger by 2002, these complaints are not leading the farms to disinvest, as the impermanence syndrome hypothesis would imply. In future studies of the impermanence syndrome hypothesis scholars should be careful to precisely define what the causal variable is, so as not to confuse the root of complaints and other assumed negative “externalities”.

The results of this study do give some limited support to one implication of the impermanence syndrome hypothesis, though, in that larger farms are more likely to be located in rural areas not affected by sprawl. While the hypothesis is usually stated in the negative (i.e., increased urban pressure leads to farm exit), examining the hypothesis from the complementary standpoint may be insightful. That is, whether farms located in more rural areas are more likely to survive, and especially, expand than their more urban counterparts.

My thesis also gives limited support to the treadmill of technology hypothesis. Large farms that utilized parlor-milking systems and generally adopted an industrial mode of production were much more likely to expand their production to become very large farms. On the other hand, adopting an industrial mode of production did not ensure farm survival. In both surveys, a significant number (4 and 2 respectively) of the farms that exited production over the next five years utilized a parlor milking system and industrial mode of production. This was somewhat surprising given that these exits represented 22% and 67% of the farm exits for the respective surveys. These farmers were also not older than the farmers who remained in dairy farming, suggesting that farm exits are complicated events that must be understood in some ways on a case-by-case basis.

Combining the insights from the two rival hypothesis suggests that dairy farming in Ontario County as well as in the region will continue to be characterized by a few farms becoming very, very large while small and medium-sized farms steadily decline in number. Those farms that are located in sprawl areas and/or those that perceive sprawl are more likely to exit dairy production, but that is not assured. This is especially the case if the actual cause of perceiving sprawl is not sprawl itself but increased friction with neighbors due to the farms' expansion. Also, while adopting an industrial mode of production makes farm operators much more likely to expand their production, it does not ensure an average mid-size farm's survival. While some of these farms' land will be absorbed by the large farms, that would seem less likely the closer one gets to the metropolitan area. This is due both to the farmland being immediately converted to non-farm uses as well as larger farms moving to more rural areas, as both this study suggests and Gilbert and Weir (2003) found in Los Angeles county.

If we are to understand the complex interaction of agricultural industrialization, sprawl, and farmland conversion, we need to examine these processes at the township level as well as at the county, state, and national level. For it is at the local level that farmers decide to continue and expand production. It is also at the local level that they experience and perceive sprawl and receive complaints from neighbors. Finally, it is at the local level that government officials, farmers, and community leaders can work together to not only preserve farmland but also farms.

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