NBER WORKING PAPER SERIES
ON
HISTORICAL FACTORS IN LONG RUN GROWTH

LATIFUNDIA AS MALEFACTOR IN ECONOMIC DEVELOPMENT? SCALE, TENANCY, AND AGRICULTURE ON THE PAMPAS, 1880-1914

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Historical Paper 96

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 1997

Forthcoming in *Research in Economic History*, vol. 17, 1997. I am grateful to the Universidad Torcuato di Tella for support during my sojourn as a Visiting Professor in 1994. I thank Northwestern University for financial support. In considering this research, I have benefited greatly from discussions at the Universidad Torcuato di Tella and the Universidad de San Andrés. In particular, I thank Roberto Cortés Conde, Rolf Mantel, Gerardo della Paolera, Samuel Amaral, and Ezéquiel Gallo. I am most indebted to Jeremy Adelman, whose scholarship inspired this line of research, whose cooperation in allowing me to use his data sources has been invaluable, and whose criticisms have improved the paper. I also acknowledge the helpful comments of Christopher Udry, Joseph Ferrie, Joel Mokyr, Karl Monsma, Frank Safford, Stephen Haber, Kenneth Sokoloff, Stanley Engerman, Laura Randall, James Simpson, Rory Miller, Francesco Galassi, Kyle Kauffman, Gregory Clark, Jean-Laurent Rosenthal, Brian A'Hearn, Lovell Jarvis, seminar participants at Northwestern University and Yale University, and conference participants at the 35th Cliometrics Conference (Lawrence, Kansas, May 1995), the conference "Institutions and Economic Performance in the Past" (University of Copenhagen, September 1995), and the All-U.C. Economic History Conference (Stanford University, November 1996). Two anonymous referees greatly helped me to clarify the paper. The usual disclaimer applies. All data used in this paper are available from the author upon request. This paper is part of NBER's research program in the Development of the American Economy. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

Latifundia as Malefactor in Economic Development?
Scale, Tenancy, and Agriculture on the Pampas,
1880-1914

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NBER Historical Paper No. 96
March 1997
JEL Nos. N56, Q15, Q12
Development of the American Economy

ABSTRACT

This paper uses extensive micro-level data from Argentine agriculture circa 1880-1914 to explore various hypotheses relating to the supposed unusual and favored position enjoyed by the owner-operated large scale estates (*latifundia*) on the pampas as compared to small-scale units operated by cash tenants and sharecroppers. I have access to several data sets which allow me to explore whether tenancy and scale mattered as determinants of technique and efficiency in the rural estates of Buenos Aires province at the turn of the century, and I obtain some surprising results. Tenants did not seem disadvantaged in terms of access to land. Accumulation of land in and of itself produced no direct gain in terms of augmented land prices (due to say, scale economies or monopoly power). And tenancy status appears to have mattered very little as a determinant of investment choices. I conclude that the case against the *latifundia*, and the pessimistic conventional view of tenant farming on the pampas rests, at present, on little firm quantitative evidence.

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1. INTRODUCTION

It is often asserted that the *latifundistas*, the landed elites of nineteenth-century Latin America, retarded economic development by perpetuating an unequal distribution of land and distorting the production structure and the balance of economic and political power. Allegedly, such inequities and imbalances have persisted to the present day, and are seen by some authors as a major cause of contemporary Latin America's problems of poverty, inequality, and underdevelopment. Typically, according to this view, the elites acquired power through land concentration and then, it is argued, used such power to monopolize land resources, to exploit better access to trade and finance, often in collusion with foreign economic interests, and to further their own political influence. To claim that such forces were at work, and that their effects have had a malign influence which has carried over for more than a century, is to place substantial blame at the door of the nineteenth-century agricultural economy of Latin America.[1]

Significantly, very little quantitative economic analysis has examined the operation of the estates of nineteenth century Latin America. Rich narrative histories have documented the workings of both large-scale estates (*latifundia*) and small-scale farms, and much is known about the nature of political, economic, and social relations in the several levels of the stratified rural society of the time. However, the extensive statistical records of agricultural operation contained in national censuses and other sources have not been exposed to the kind of econometric scrutiny that might help validate, or perhaps refute, the case against the *latifundia*. Such analysis, as will be shown in this paper, could potentially answer several key questions in this debate: Did large estates come to dominate the land distribution, as seen in an increased concentration of land over time? Were scale economies in agriculture such that, by raising land values upon agglomeration, they encouraged concentration of land parcels and thus profit? Did owners, by enjoying better access to credit from a financial sector biased in their favor, find it easier to make investments and thus profit? For the economic historian, such questions might be resolved by the appropriate choice of econometrically testable hypotheses, and by the availability of the right kind of data. Although it has never been tried before in the context of nineteenth century Latin America, in this paper I aim to show the feasibility of this quantitative approach. And even if every element of the full critique of the *latifundia* cannot be reduced to verifiable or falsifiable economic propositions, I believe the merit of the method lies in its attempting to lay bare the purely economic operations of the different strata of the agrarian economy.

For the case against the *latifundia* is indeed a broad range of attacks on many fronts, not all economic, and plainly not all of them framed as a set of coherent, testable

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[1] The focus of this introduction is the long-run and short-run *economic* effects of the particular system of landownership and land distribution in Latin America, and, especially, in Argentina. Discussion of the *political* effects would be required for a complete analysis, but is beyond the scope of this paper. On these questions, see the interesting application of Barrington Moore's thesis (from his *Social Origins of Dictatorship and Democracy*) as discussed in the various essays in Huber and Safford (1995). In the essay by Halperín (1995), it is argued that, despite appearances, the Argentine case is exceptional, however, and does *not* fit so easily into a Moore-style framework.

propositions. The critique has been closely associated with both the Marxist and *dependista* literatures, but by now, given its widespread acceptance, it may be called a traditional view or even the conventional wisdom. It is certainly textbook material. Surveying the scene, Tulio Halperín (1993, chap. 5) notes that after independence, the shifting political coalitions of Latin America could not rid themselves of foreign dependence, what he calls a "neocolonial compact." Necessarily, the major players were the landed oligarchs and the commercial middlemen with overseas ties, key groups in the narrow social and political base of the early republics. Frequent booms in the primary-export economies seemed mainly to benefit these monopolistic or oligopolistic domestic interests, who translated economic assets into political capital. In the *dependista* tradition "[p]owerful foreign interests possessed numerous indirect paths of control that are difficult to trace but widely believed to be important in the internal politics of the period" (Halperín 1993, 179). Outside this privileged group access to land remained a "serious problem": land concentration changed very little over time despite the vast increase in acreage, a result which could have been avoided if newly alienated lands had been more equally allocated by the state.

The persistence of concentrated landholding over time may still be a puzzle, however, since "economies of scale in agriculture were comparatively rare," requiring an explanation for the "relatively isolated examples of successful smallholdings." One can pursue an economies of scale argument in (at least) two ways: for some crops, if scale economies were present, then concentration would be desirable, absent any distributional concerns, simply to raise efficiency, as in, say, tropical crops like sugar. The temperate crops do not easily fit in the same scheme, and it is here, as on the Argentina pampas, that the counterargument surfaces: that, despite the lack of advantage to concentration—or even some benefits of small-scale operation—the large-scale land holdings persisted in a concentrated pattern. Of course, this is first an empirical question, and evidence of land distribution will be needed, and shown later, to confront this first dimension of the puzzle. It requires us to note, therefore, that exceptions to large-scale operations *were* sometimes seen, as in the occasional success of small agricultural colonies like those in the Argentine province of Santa Fé. Further South, the small-scale tenant farms on the Argentine pampas in Buenos Aires province—sitting side-by-side with the large estates of landowners—provide us with ideal case-study material for this paper (Bulmer Thomas 1994, 93–95). In this setting we can examine close-up the comparative performance of different agrarian institutions in nineteenth century Latin America.

The Argentine case is certainly relevant as an oft-cited example of land monopolization by elites in the nineteenth century, and of the use (or abuse) of social and economic power by said elites to constrain and disadvantage the tenant farmers, sharecroppers, and peons who labored beneath them. And it is a canonical example of how agrarian institutions in the last century are invoked as an explanation of long-run development failure. How did the landed *gente* become the villains of the piece? Jeremy Adelman (1994, 81) has recently noted the widespread characterization of landowners as a class engaged in acts of land-hoarding and speculation that drove prices sky-high and excluded tenants from making the transition to land ownership, with any or all of this subject to a class-conspiracy interpretation. The ostensible starting point for this process was the "modernizing" regime of General Julio Roca begun in 1880, which

"centered on an alliance between the landowners of the riverine provinces (especially Buenos Aires and Santa Fé) and foreign commercial interests," thus downplaying the influence of urban and agricultural workers, and continuing an established tendency to ignore the masses of the interior (Halperín 1993, 188–89).

The familiar refrains run through several key Argentine histories, and we may find two notable quotations in Roberto Cortés Conde's *El progreso argentino* (1979), a volume which made a challenge to the accepted view. The first originates with James Scobie, in the introductory perspective to his seminal history of Argentine wheat, *Revolution on the Pampas* (1964), who speaks thus of the transformation of the pampas and the landowner-tenant contrast:

> Those who already had land, power, or money monopolized the newly developed wealth of the pampas. The man who tilled the soil or cared for the herds eked out a meager existence....There was little opportunity for education, sociability, or self-improvement. Instability and transience characterized every aspect of his life....As a result the small independent landowner or farmer never gained a foothold on the pampas. (5–6)

Alternatively, from a more distant era, we might consider Carl Taylor's views in *Rural Life in Argentina* (1948) concerning the tension between land reform and monopolization and its historic, colonial origins common to *latifundia* throughout Latin America:

> Everyone Desires and Believes in Landownership. There is probably no society in the world whose members prize the ownership of farm land more highly than Argentina and there is no conviction more widespread among Argentines than the idea that a wider distribution of landownership should help to develop a better and more democratic social order. This conviction is shared alike by many owners of large tracts of rich pampas land and the more than 200,000 tenant farmers large and small.

Taylor then explains that despite this shared conviction, land reform never happened as a result of the privileged landed class holding onto their land. This elite dated back to the original conquistadors, he claims—a group that, failing to find precious metals, "sought compensation for their disappointments by arrogating to themselves something approaching a monopoly in the ownership of lands." Thus the new immigrants didn't have a chance:

> The fathers and grandfathers of the majority of present Argentine farmers, however, came to the country after most of the land was distributed, and the great body of tenants, therefore, are the sons of men who never owned land themselves, not men who once owned farms and lost them. They are, for the most part, inmigrants or sons of inmigrants who started farming as hired men and rose to the status of tenants but never advanced any further up the agricultural ladder. Most of them are occupying the highest tenure status of their lives.

The theme was not new, even then, and tension over this struggle for land surfaced in the debates over land reform even among the elite themselves in the nineteenth century. The problems were palpable enough to Mark Jefferson, writing for the American Geographical Society in *Peopling the Argentine Pampa* (1926, 165, 173–74) about the landowner attitude and the struggles of the sharecropper, and the handicaps and penalties of the share tenancy contract:

> Society is to [the Creole landowner] stratified into upper and lower classes....The glimpses of European society imparted by travel to some of the Creole upper class have not tended to change this mental attitude very much. In the peasants of Europe they see peons and like to regard themselves as Argentine representatives of Europe's landed aristocrats. I believe this attitude is at the back of the present check in settling the country and improving agriculture...

Jefferson then notes how the various requirements of the tenancy contract prove an obstacle to the poor tenant, from expensive equipment, to the share of the crop he must give up, to the extent of cultivation stipulated in the contract. Thus did few prosper, we are encouraged to believe, and an example is illustrative of the way the system worked:

> At Tres Arroyos, in the Province of Buenos Aires, a good many Italians had town subdivisions of 30 to 50 hectares, a size that in local practice did not suffice to support a family, and so they had to hire land elsewhere. Most of the country was in *latifundia*, nine of them belonging to Italians. A succession of bad harvests following 1900 brought the farmers of Tres Arroyos almost to bankruptcy. A good harvest in 1904 produced $7,000,000 worth of grain in the neighborhood, but the colonists were so deep in debt that few crumbs of the harvest got to them....

Thus we might suppose that the nature of contracts and other economic conditions stacked the deck against the tenant farmer. At the root of the problem allegedly was his inability to freely own and farm land of his own, a product of the concentration of land in the hands of the elite. In this view the tenant stands as a victim of the system and "[u]ntil he can get land of his own that will bring the fruit of his labors into his own pockets he will have no great love of the country, and that will not be until the big *estancias* are broken up."

Such descriptions are not unusual, and set the tone for most traditional discussions of rural development in nineteenth-century Argentine history.[2] The Argentine case relates to similar discussions of the impact of *latifundia* in other parts of Latin America. There, much of the present literature makes bold claims that the *latifundia* had peculiar and adverse economic implications over a very long run: implicitly, that scale and tenancy effects mattered, and that the Latin direction of large agricultural estates constituted an unfortunate "choice" as compared to, say, the Jeffersonian ideal, the political economy of North American agriculture built around the institution of the family farm. Indeed, such alternative directions of development were hotly debated in nineteenth-century Argentina, with the Jeffersonian ideal favored in theory, but never realized in practice. The malign influence endured, then, as elites conspired in obstructing a transition toward land reform and redistribution.

In a broader literature on long-run development, many authors argue that such institutional arrangements had implications for long-run growth and divergence, and the failed transition to successful capitalist development. As Albert Fishlow (1996, 3) notes,

> Where there is a large rural population, productivity and equality are both served by land reform. There is little doubt that the high rates of inequality in

[2] Other authors sympathetic to the plight of rural laborers in the face of the landed elites would include Carl Solberg (1970) or Hilda Sabato (1990), for example.

> Latin America trace back to the initially much higher rates of inequality of land distribution in the region in the nineteenth century and even earlier in some cases. And there can be little question, despite today's dwindling enthusiasm, that fairer allocation of this basic asset can stimulate broadly based development.

Cynthia Taft Morris (1995), following Morris and Irma Adelman (1988), has reasserted the importance of state policies in checking the power of landed elites in the British settler economies versus in Brazil and Argentina, and argues that such policies, by widely distributing assets, encouraged human capital accumulation and technological change. Along similar lines, Stanley Engerman and Kenneth Sokoloff (1994) examine the role of institutions and, especially, the unequal distribution of land as preserved by an oligarchic state, as a key contrast between North American and Latin American development patterns and a plausible cause of long-run divergence.

If land distribution and tenancy mattered, then this ought to have been reflected in economic outcomes. And if they mattered in a drawn-out and generalized argument—which runs from agrarian institutions of the nineteenth century, through early capitalist development in resource-rich economies, to broad conclusions about divergent paths of development over the very long run—then we ought to find evidence to support the contention that agrarian tenancy institutions and scale effects had an immediate, direct, and measurable impact on activity at the very start, for the whole ensuing argument is predicated on that assumption.

I will argue that the logical problem here is best viewed as a two-stage argument: first, to verify the disadvantaged position of the tenants; next, to connect this to the long-run economic disappointments plaguing Latin America. The link is not obvious, yet is easily swept aside. The apparent paradox at hand, affecting the tenants of the pampas at the turn of the century, demanding validation and explanation, is stated concisely, but not resolved, by David Rock (1987, 178):

> [1]...the appreciation of land values [made] tenancy neither unpopular nor irrational. Farmers prospered more quickly as tenants than as independent smallholders, and their prosperity over time may also have been greater. [2] Even so, both tenancy and the new estancia system had a long-term regressive effect on the pampas economy and the pampas society.

There are two hypotheses here. On the second hypothesis, I have little to say, except that absent any damning evidence as to the economic disadvantages of tenancy for the tenants themselves, we must surely retreat to a different form of argument, where the "regressive effects" seen in long-run development outcomes may stem from income or wealth inequality, or non-economic mechanisms (e.g., political channels), *but not the agrarian institutions per se*.[3] Such an argument, depending on its formulation, may still be

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[3] The point deserves emphasis. There are many reasons to expect the wealthiest Argentines to turn to land investment and procure a lot of this asset along the way. It was subject to vast capital gains as anticipated frontier expansion drove up land scarcity. It was also the basis of Argentine comparative advantage before World War One in an expanding primary export business with a market as large as the world. Low tariffs made domestic industrial enterprise less attractive, perhaps (why not invest in British or German or U.S. industry instead?). And exchange risk (small under the gold standard?) or country risk, made land possibly the prime domestic asset. Furthermore, we also have the claim that land ownership conveyed a higher social status, a form of nonpecuniary return valued in Argentine society. It is, to repeat, no surprise that the wealthy few chose pampas land as a large part of their portfolio. But were adverse economic consequences a result of their wealth alone or, given their wealth, was it a

entirely consistent with the dynamic models of Sokoloff and Engerman, or the work of Morris, but might now be seen as something distinct from Latin America's peculiar institutional inheritance from colonial times. The essence is to separate the idea of unequal distributions of wealth and political power and their effects from the impact of certain agrarian instiutions, and this distinction could be more finely drawn in the literature.[4]

In the present paper, however, I seek to support the first hypothesis outlined above: I argue that tenants could succeed on the pampas, at least as well as landowners. This is obviously an open question, especially from the perspective of quantitative analysis, but it has gained some currency with the works of historians such as H. S. Ferns (1973) or Adelman (1994). According to the traditional view, it ought to be possible, even easy, to reject such a claim, and to demonstrate the unusual advantages that land concentration gave to the Argentine landed elites—that it conferred benefits in terms of increased profits and land values, easier credit and enhanced investment opportunities. Yet to my knowledge, no previous quantitative analysis has been pursued to address these questions, and to examine and test the implicit hypotheses concerning the malign influence of the landowners. It is not for lack of testable hypotheses, nor for want of data. This paper uses extensive micro-level data from Argentine agriculture on the pampas circa 1880–1914 to explore the supposed advantage enjoyed by landowners with large plots over small-scale plots run by cash tenants or sharecroppers. I have access to several data sets which will allow me to explore whether scale and tenancy effects mattered as a determinant of technique and efficiency in the rural estates of Buenos Aires province, the heartland of Argentine agriculture at the turn of the century.

2. CONTEXT

Before examining data and hypotheses, it is worth spending a moment to get familiar with the characteristics of the rural economy. This section describes the historical and geographical context of the pampas in the late nineteenth century. I begin with a discussion of the expansion of the frontier after 1800, and some detail on soil and climate conditions. I then move on to discuss the geographical distribution of arable and pastoral activity in Buenos Aires province from the 1880s to the 1900s. Lastly, I discuss the settlement of the province, the division into *partidos*, and the penetration of the interior by the ever expanding railroad network.

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direct result of their portfolio choice? Implicit counterfactual: keeping the Argentine's wealth distribution the same, would a massive equity swap with foreigners of pampas land for British or U.S. securities have changed the development dynamic?

[4] Again, I would stress that many socities have had unequal wealth and power distribution, but not the same agrarian institutions as Latin America, yet followed a variety of development paths. Is the answer really to study the comparative dynamics of development and how these societies handled unequal wealth and power, and what that meant for economic policies, trade , investment, and other sources of economic growth, rather than to pin everything on the differences in agrarian institutions?

2.1. Initial conditions: history and geography of the pampas before 1880

Historically, rural activity in the Spanish colonial economy had little to do with the modern-day province of Buenos Aires. Pre- and post-independence Argentina found its economic center of gravity in the interior of the country, toward the northwest, with settlements running along the old lines of communication from Upper Peru and the vicinity of Potosí, stretching southward down the riverine corridor to the remote outpost of Buenos Aires. Indeed, colonial restrictions on trade had entailed the overland shipment of (legal) European trade with the Rio de la Plata along an interior route via the ports of Peru and the isthmus of Panama. It was only later in the nineteenth century, with the ocean trade routes open, and an internal migration toward the littoral in progress, that economic activity and settlement in the eastern coastal regions grew, associated with a distinct outward shift in the pampean frontier as delineated by the forts erected to defend the Creoles from the indigenous tribes to the south and west. It was thus that the agrarian economy spread from the confines of the littoral and into the lands of south of the Río Salado.

The late exploitation of the fertile pampas was thus ironic, given, as Scobie (1971) notes, that these were the first temperate grasslands encountered by European man. The soils were good, and their fertility, by popular account, was the excuse for Argentina's historically "backward" agriculture, with farmers apt to rely on the richness of the soil, and resist the use of machinery—in the words of an American observer, cited by Adelman (1994, 241), they were content to "merely scratch the ground a little and left the rest to providence." The rich soils extended over most of the pampean zone. Only drainage constituted a problem, varying from mediocre to poor in the flat and low lying pampas, being especially bad in the flood-prone and canalized basin of the Salado river. Perhaps more than any other feature, the variations in elevation and drainage should be considered as a possible source of spatial heterogeneity in agricultural technique and efficiency, an aspect we shall keep in mind (cf. Scobie 1971). The temperate climate offered a long growing season in most areas, with a threat of dangerous early or late frosts only in the south of Buenos Aires province, especially in the Ventana and Tandil Hill regions. As the climate data from the *Segundo Censo Nacional* (1895) indicate, the temperature gradient within the province of Buenos Aires ran almost exactly due northwest, and the rainfall gradient almost exactly due northeast.

2.2. Agrarian development on the pampas

The entire region proved extremely suitable as a basis both for ranching (the raising and fattening of both sheep and cattle using either natural or planted pastures) and cereal cultivation (with plantings of wheat, corn, barley, flax, and alfalfa all common). However, initial conditions certainly came into play: the early activity along the estuary was by pioneering ranchers, and at mid-century products like jerked beef, tallow and hides dominated the environs of Buenos Aires as much as they dominated the export statistics. Even through the 1870s and 1880s, arable activity was centered further to the north, notably in the *colonias* of Santa Fé and Entre Ríos. Indeed, not until 1908 did the wheat area in Buenos Aires province exceed that in Santa Fé or any other province (Cortés Conde 1979, 64). Sheep were largely displaced to graze on the barren plains of

Patagonia so as to clear the rich pampas land for a new mixed farming of cereals and fodder crops and the pasturing of cattle. Beef and wheat were principal exports, and the whole of the pampas became the engine room of the Argentine economy: around 1914, Bunge's estimates, though possibly exaggerated, attributed to this region 90% of the nation's telephones and automobiles, 42% of *all* Latin America's railroad mileage, and maybe *half* of the entire exports of Latin America (Rock 1987, 169, 176–77).

The basis for this economic expansion was principally extensive growth: in the course of this progress, the agricultural frontier marched south and west from its estuarine confines, and took both arable and pastoral activities along with it. Evidence from the 1881 and 1908 censuses reveals some details of this expansion (Cortés Conde 1979). Several features warrant mention. Even in 1881 the pampas were clearly an area of mixed farming. Arable and pastoral activities coexisted across the entire region. In 1881 the frontier was still well inside the western boundary of the province, with no *partidos* yet defined in the far west.. Cattle ranching appears to have been located in more remote areas, with most wheat production closer to the city. By 1908, the census shows that the spatial distribution of arable and pastoral activity had changed dramatically. Wheat dominated in the far south and west of the province, in the most recently settled *partidos*, and was relatively scarce in the east. Corn made its strongest appearance in the north close to the river. Cattle and sheep were spread throughout, but with low density in the western and southern wheatlands. If anything, these developments caution that crop mix and the arable-pastoral balance must remain relevant as control variables in any analysis at the micro-level, if only because the type and intensity of farming varied so much across the province.[5]

2.3. Location and transportation on the pampas

In this study, we will spend much time focused on micro-level developments in the province of Buenos Aires, sometimes at the *partido* level and sometimes at the unit level. Map 1 shows the distribution of *partidos* (administrative units of county size) in the province, and also highlights a group of twelve *partidos* selected by Adelman (1994) in his sampling of the 1895 second census manuscripts, a key source for the analysis which follows. Adelman's twelve cover a variety of locations across the province, and he divides them into groups of four labeled North, Center and South.[6]

The existence of such data, and broader *partido*-level data culled from census and other sources as discussed below, further raises the question of appropriate

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[5] The censuses also reveal a puzzle, but one apparent in the narrative history too. A commonplace in the historical literature is that wheat began to dominate in the core of the province on smaller units, with ranching confined to larger units in the more remote lands (cf. Adelman 1994, 91). Yet the 1908 census shows quite the reverse—wheat concentrated in the outer reaches, ranching nearer the city.

[6] Less clustering, particularly in South and Center group might have been preferable, but was infeasible: although the 1895 manuscripts stand out as having survived (the 1914 third census manuscripts have been lost), they are still imperfect. The *cedulas* (slips) for several important *partidos*, like Nueve de Julio, General Villegas and Trenque Lauquen were missing from the 1895 archive (Adelman, 1994, Appx. 1). In addition many slips were filled in haphazardly by careless census takers. Imperfections aside, by giving us a detailed picture of unit level operations at almost 1,500 sites, Adelman's data collection represents a invaluable addition to our stock of information.

controls for spatial heterogeneity in our samples. Several obvious variables stand out in addition to the climate, soil and land-use data mentioned. Cortés Conde (1979, 58), for example, considers two variables vital for any explanation of the evolution of land use and land values, and, by implication, the development of the agrarian economy of the pampas: labor scarcity and transportation costs.

Census and other documents contain information on population and partido size, from which we may infer population density, a crude proxy for labor abundance. In the hinterland, many small towns served primarily as pure railheads for primary production activity, and they also served as centers of local banking (such as it was) and petty crafts. But these centers were small: in a province the size of France only ten townships had populations greater than 12,000 in 1914, and nothing could match the scale of Buenos Aires itself. The population was still thinly settled and few owned land: only a quarter of land was broken into units of 500 to 1,000 hectares, and about one fifth of the land area was concentrated in 584 holdings. Population and labor were scarcest in cattle ranching areas (1–2 persons per square kilometer) and more abundant in cereal areas (wheat: 3–4 persons per square Kilometer; corn: up to 15) (Rock 1987, 177).

On transportation costs, the whole story hangs on the expansion of railroad networks. All roads again led to Buenos Aires, and in these decades tracks spread across the pampas like a spider web. Suffice it to say that the railroad occupies a central position in Argentine historiography, being both the vehicle for expansion into the pampa hinterland and also the means to export-led growth, linking primary producers, through the port of Buenos Aires, to world markets for beef and wheat. For the present study I treat railroad expansion as exogenous, and merely track the expansion of the railroad *partido* by *partido*, matching rail lines to atlases and *partido* configurations. I use an indicator variable of railroad presence plus a measure of distance to Buenos Aires as proxies for transportation costs, introducing these as control variables in the analysis of cross-*partido* variation.

3. DATA

Four data sets covering the period 1888 to 1914 (and beyond) can be compiled from census and other sources, as described below. The variables of interest include the value of land on estates (the price per hectare), the investment activity on the estates (agricultural machinery and animal stocks), estate characteristics such as the size of estates, the type of tenancy (ownership, cash lease, or sharecropping), the crop mix or land use, the location (e.g., distance from the port of Buenos Aires), the access to land transportation (a nearby railway), climate data (crude temperature and rainfall proxies), and financial development in the local area (the presence of banks). Such data can be found in several data sets, all of which I will employ at various stages of the analysis, and which I now describe. In each case I manually coded the data for computer use.[7]

[7] The four data sets were supplemented by location information (longitude and latitude) furnished by a contemporary Argentine atlas (*Atlas de la República Argentina*), and by information on the extent of the railway network from various sources (Jefferson 1926; Scobie 1964; 1971).

3.1. Latzina's *Géographie*, 1888

Francisco Latzina's *Géographie de la république argentine*. Published 1888. The volume was written by the national director of statistics who later supervised the 1895 census. Contains data on land values, populations, animal stocks (cows, horses and sheep), total areas, and areas cultivated by *partido* (county) in Buenos Aires and other provinces. Maps indicate railway access. Allows analysis at the *partido* level.

3.2. *Segundo Censo Nacional*, 1895: summary volumes

República Argentina, *Segundo Censo Nacional*. Published 1895. Summary data by *partido* includes most variables of interest, including land area, number of units, numbers of owners versus renters versus sharecroppers, areas planted to wheat or corn or flax or barley, numbers of plows and reapers and harrows, and numbers of banks. Useful isotherm and isorainfall contour maps suggest rudimentary climate proxies by distance northwest and northeast of Buenos Aires for temperature and rainfall respectively. Allows analysis at *partido* level for Buenos Aires (and potentially other provinces).

3.3. *Segundo Censo Nacional*, 1895: Adelman's subsample

Jeremy Adelman, *Frontier Development*, Appendix 1. A subsample of unit level data from twelve individual *partidos* in Buenos Aires province culled from the original census manuscripts. Target sampling 1 in 3; actual sampling closer to 1 in 4. Includes size of unit, investment measured as the numbers of plows or reapers or harrows or threshers, and the crop mix measured as areas sown to wheat, corn or alfalfa. Allows analysis at the unit level in the *partidos* of Baradero, Junin, Pergamino, Chivilcoy, Tandil, Olavarría, Tres Arroyos, Bolívar, Suárez, Pringles, Guaminí, and Alsina.

3.4. Archivo General de Tribunales: Adelman's subsample

Jeremy Adelman, *Frontier Development*, Appendix 2. A (nonrandom) sample of large, important estates in the national probate records circa 1880–1940. Includes land value, the value of improvements to the land, scale, the value of investments in machinery and animals, and *partido* location. Allows analysis at estate level.

A few important things deserve note about the data. The first is that we have no information whatsoever about agricultural outputs at the micro (unit) level, as census takers did not ask for this information. Thus, we cannot perform any tests of efficiency directly, since we cannot estimate production functions (although we can test indirectly using price evidence, as discussed later). This is the major weakness in the data which is available, and requires us to consider alternative ways to distinguish between operations on units of different size and tenancy status. Second, Adelman's subsample is at the level of the unit, rather than the estate. Typically a census taker would go to an estate, survey the owner's unit, then survey any tenant units in the same estate. Thus we can focus on the unit of operation using this data, but not the unit of ownership. This, I

argue, is an advantage as we want to know how choice of technique varied by tenancy status, a choice which includes size of land plot used and equipment available. However, it must be emphasized that the land distribution by unit says nothing about the land distribution by ownership. For example, one person might own all the land in one locale, and either operate it as one large unit or rent it out to many tenants. We can pick up this distinction in the data. But we cannot know whether land is indeed owned by one person or many. My satisfaction with this approach reflects what I consider the main object here: not to study who owned what wealth (land) but who got to use it (owner or tenant) and how, and what difference it made. The exception to this rule is, of course, the probate data, which is information on estates by owner, and which does, to some degree, allow us to examine the land concentration issue from the ownership perspective.

4. HYPOTHESES AND RESULTS

My reading of the literature suggests several natural hypotheses concerning the supposedly superior or privileged position of the landowners with large estates. I will elucidate each general hypothesis in turn and then draw out the method by which I propose to test each hypothesis using the available data.

First, we might carefully re-examine the evidence on trends in land concentration to place the monopolization thesis under direct scrutiny. Having several *partido* and unit level data sets, we are in a position to evaluate trends in land inequality with data at a new level of disaggregation. We should be able to say more about such trends, and explore possible regional heterogeneity.

Second, we might ask, were large estates more efficient than small estates? This hypothesis addresses one possible reason for the alleged desire to agglomerate and concentrate land. In effect, we are asking: was concentrated land (agglomerated in large estates by the elites) more valuable (i.e., more efficient in production) than land in smaller parcels (operated by entry-level owners and tenants)? I have already pointed out that no data on output is available, so a production-function approach to efficiency estimation is precluded. However, we may adopt a natural econometric specification to test the hypothesis, and pose the natural question: was land of similar characteristics associated with higher rents or land values when agglomerated ? Of course, we must control in the spatial dimension for location and in the time dimension for general trends in land values. Using the four data sets we may use cross-section and time-series estimation to establish whether there were significant scale effects present as determinants of land values, both at the *partido* level and at the estate level. The conventional wisdom (hypotheses concerning the inherent profitability of agglomeration plus the advantages of *estancia* monopolies) would suggest a positive and significant effect of scale on land values.

Third, we may ask whether estate characteristics, including scale and tenancy, had any impact on investment activity. Important controls would be crop mix, land quality, distance, climate, access to local banks and the like. According to the conventional wisdom in the Argentine case, owners with large estates enjoyed favorable access to credit, and, if this had any real effects, it should have manifested itself in investment outcomes. Such estimation is commonplace in the modern empirical

development literature.[8] Such analysis typically controls for farm attributes and allows distinctions based on tenancy arrangements. The approach thus provides another test of the effects of sharecropping on investment incentives, an interesting related issue. Applying the same methodology in a historical context is a natural extension which allows us to examine the allegedly important role of tenancy and land concentration on agricultural outcomes in Latin American development.

The following sections detail the methods used for testing the various hypotheses, with reference to the use of each of the data sets, and provide some discussion of the results.

4.1. The changing pattern of land concentration and ownership

The first major hypothesis I set out to test concerns the question of land concentration. The monopolization thesis contains, I argue, at least two implications worth separate investigation. If landed elites did indeed monopolize land, it would have entailed a squeeze on land available to tenants: as land was acquired by the elites to secure the monopoly, it would have facilitated agglomeration by owners, and would have taken land out of the hands of tenants. The conventional wisdom here suggests that large estates fell into the hands of owners, with small parcels left to the tenants. This hypothesis should be easily testable if we can find evidence on the scale distribution of land holding classified by tenancy status. Such a test may be viewed as a test of how skewed the static distribution of land was in a given cross section. I propose to study unit size distributions by tenancy using Adelman's unit level sampling of the 1895 census.

A second related hypothesis concerns how the overall distribution of land evolved dynamically over time. There the relevant variables are measures of land inequality and how they change over a span of several years. The monopolization thesis would be supported here by evidence of a concentration of land holdings and an increasingly unequal land distribution. Other authors have examined this question. Cortés Conde (1979, 138) found considerable evidence of subdivision of land holdings both at the province level and in three *partidos*, Baradero, Nueve de Julio and General Villegas, suggesting no tendency toward monopolization in the land distribution as a whole (Table 1). The evidence is consistent with other data on the rise of tenant operation, and the decline of ownership, trends one might reasonably associate with an evening of the land distribution (Cortés Conde 1979, 118, 121). A similar leveling in land distribution for the province was also found by Adelman (1994) and is shown in Table 2.

Returning to the first question, the general shape of the land distribution in Adelman's 1895 unit level subsample for the twelve *partidos* is summarized in the boxplots of Figure 1. The plots already caution that a correlation of tenancy with land distribution may be hard to identify. Owner plots showed a higher variance than

[8] The method is akin to the framework for relating investment activity to firm characteristics used the modern empirical finance literature, where variables like scale and cashflow are typically related to investment as a measure of the presence of bias in the capital market. Indeed, such approaches have been successfully applied in recent micro-level analyses in the development literature, for example, in modeling farmers' choice of technique.

renters, with sharecroppers having least variance. The boxplots of log land area on each plot (close to normal in its distribution) for each tenancy type show some notable outliers in each category, especially some "far below" cases for renters. However, the median and mean unit area did not differ that much between owners, renters, and sharecroppers: the differences were not statistically significant at conventional levels. And, surprisingly, owners were operating, on average, *smaller* units than tenants. (For an explanation of boxplots, see the notes to the figure.)

Beyond raw data averages, we may ask if such differences still obtain after controlling for location. The simple OLS regression estimates from Table 3 indicate that, even controlling for *partido* fixed effects, sharecroppers had significantly larger land parcels than owners (by 14%), although the renters' and owners' mean unit size were indistinguishable (renters 0.7% larger, but insignificant). Thus, if land monopolization is supposed to have wrested control of huge tracts of land from tenants for the benefit of land-hoarding owners, it is certainly not manifest in the access-to-land evidence contained in the 1895 census data. Of course, the tenants did not own any of the land—the entire sample was owned land, and the "own" label refers to owner-operation. What this data shows then, is that even if land concentration can be proven, it did not entail the marginalization of tenants on small parcels.[9]

Combined with Cortés Conde's (1979) and Adelman's (1994) data, the above evidence suggests a more optimistic view of land concentration trends in the province of Buenos Aires. Land concentration declined over time in the late nineteenth and early twentieth centuries. In this sense, the monopolization thesis appears weak. Moreover, tenants apparently met few obstacles in obtaining land for operations—their plots were, on average, no smaller than those of owner-operators. However, this is not to say that conditions did not change over time—a snapshot from the census of 1895 describes conditions prior to the great land boom of 1900–14. Adelman (1994) notes that in this phase, as land prices skyrocketed, collateral demands may well have constrained tenants' access to land, although even then the tendency toward subdivision continued as seen in Cortés Conde's data.

Clearly these questions warrant further work to permit us to understand better the evolving land market, but for the present, I claim, we can at least dispense with the monopolization thesis: the market was simply too "thick"—and too competitive—to allow any such market power absent a much higher degree of concentration. We may also doubt that scale was any fetter to the agricultural operations of the tenants, as they were plainly able to establish domains the equal in size of their landowning competitors.

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[9] Strictly, all the land is held in *latifundia*, and the issue is who gets to farm directly and who decides to rent out to tenants. Theory dictates that this will be governed by the nature of the crops and the extent of the principal-agent problem. It should be the target of future work to endogenize this overarching tenancy choice which, for the present purpose, is taken as exogenous. However, since crop choice is also endogenous (as a tenant I can plant what I want so long as I pay the rent), we face problems in finally deciding what drives the tenancy choice, beyond, say, stochastic disturbances at the unit level. I am grateful to James Simpson for highlighting this point.

4.2. The returns to land concentration

In this second exercise I estimate the returns to land aggregation, testing the hypothesis that land in larger parcels had greater value (was more profitable or efficient in use), *ceteris paribus*. The main challenge is to control for possible omitted variables. In cross-section data these may be location-specific characteristics that might affect land values, such as transportation costs or population density. In time-series data, we must, in addition, factor out any general trends in land prices. The available data allow us to explore both approaches.

4.2.1. Value and scale effects in cross section

We can use Latzina's 1888 data to examine the relationship between scale and land values at the *partido* level for the province of Buenos Aires. Table 4 reports these results. The dependent variable in the regression estimates is the value of land per hectare in the *partido*. The independent variables for each *partido* consist of a measure of scale or land agglomeration (total crop area per unit), the population density (persons per km^2), the distance to Buenos Aires (in km), the railroad dummy variable (equals one when a *partido* has a railroad connection, zero otherwise), and climate proxies for temperature and rainfall (distances NW or SW of Buenos Aires).

It can be seen that the climate proxies add nothing to regression (2), and they are omitted in the preferred regression (1). A railroad-distance interaction, added to explore the possibility that rail access enhanced land values more in the remoter areas also appears insignificant and is dropped.[10] The population density and distance from Buenos Aires terms have predictable and significant coefficients: proximity to the city and abundant labor supply enhanced land values. A railroad also raised land values (by about 15%–20%) but the effect was insignificant. Still, the main effects work, and in the right direction as suggested by Cortés Conde (1979): land values were driven in large part by population pressure and transportation costs.

In neither specification, however, does the scale effect appear significant; indeed, it is signed negatively, but the coefficient is of extremely low significance. Overall, the results lend no support to the claim that land concentration was profitable, in that regions with highly concentrated land did not have significantly higher land values. Of course, a number of difficulties arise with the preceding approach, and an unfortunate level of aggregation means that we are only looking at *partido*-level averages, which might obscure unit-level enhancements in land values for large land parcels.[11]

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[10] The scale effect was subject to a Hausman specification test for simultaneity using all regressors as instruments in specification (1) to confront the suggestion in the literature that scale and remoteness were correlated. This simultaneity appears not to matter for the present purpose.

[11] In addition, the methodology makes assumptions about the non-homogeneity and non-fungibility of land. It might be unreasonable to expect such an experiment to reveal a price gap between large and small units for several reasons, not least because trades in the land market ought to arbitrage away such differences. The method therefore rests on a presumption that if smaller units are inefficient (have lower values) they nonetheless persist, so as to be observed in our sample as distinct from larger units, and even as distinct from neighboring small units with which they themselves might be agglomerated to form a higher-value large unit.

4.2.2. Value and scale effects in time series

The aforementioned methodological concerns are unlikely to be unraveled with any available cross-section data. The problems are similar to those faced by students of the enclosure movement in England: the best work on enclosures tracks the same land parcel for decades, even centuries, before and after enclosure, and examines the land value on a plot-by-plot basis, this being the only failsafe way to address omitted-variable problems inherent in any cross-plot comparsion (cf. Clark 1994). Equivalent data for the Argentine situation is not available: we do not have unit level data on land values, and certainly not linked to a history of parcels and their agglomeration. Therefore, can any study in the time dimension assist us?

Table 5 uses one possible source for such an exercise. Adelman (1994) sampled the probate records of the Archivo General de Tribunales in Buenos Aires, examining the total value of estates in probate from the 1880s through the 1940s (Adelman 1994, Appx. 2). I have coded this information for computational use. The data includes *partido* location, estate size, and estate value, including land, improvements, machinery and animals. In contrast to the sample in the previous exercise, this data has as its unit of observation the owner, not each agricultural unit. This may be helpful for untangling the question of accumulation effects of owners on land values (e.g., via market-power effects) from unit-level agglomeration effects (e.g., conventional scale economies). This data provides some corroborative evidence, therefore, at a different level of aggregation.[12]

I confine my attention to probate cases with improvements explicitly measured (so that raw or unimproved land values may be inferred). A year variable factors out the time trend in land values in all cases. Various regressions control for geographical effects (distance from Buenos Aires or region effects, and also climate proxies), and all allow for possible scale endogeneity (although the instrument list is sparse) to examine the suggestion in the narrative literature that distance and scale were coeval and codetermined. The bottom line is that all these regressions tell a similar story about the 77 out of 164 estates for which improvements data exists. As before, scale has no significant impact on land values, even here at the ownership level. The major determinant of land values, aside from a 5% per annum time-trend increase, was the distance from the city, with climate proxies again of negligible significance. The distance-land value gradient shows some tendency to flatten over time, as we might expect given diminishing transportation costs (railroad expansion) in the vicinity of an urban/port center, but the effect is of marginal significance.

Thus, the prior cross-section findings are buttressed by the time series analysis. Although neither the data sets nor the methodology may be considered ideal, the findings suggest we should hesitate to assume that land "monopolization," even if a reality, did indeed confer advantages in terms of increased land values or rents. Much of the traditional literature has always asserted that land concentration had a purpose: to make the wealthy landed elite wealthier still. Wealth surely facilitated the purchase of

[12] The sample is not ideal, however. Adelman consciously constructed a nonrandom sample of "important" landowners from the province—indeed only the major landowners would be involved in probate in the capital, since smaller estates typically went to the local courthouse for probate. Adelman's sample contains few estates below 500 hectares, so we can only examine the scale effects at the top end of the distribution.

additional land (how could it not?), but the secondary argument, where a reverse causation or positive feedback runs from land concentration back to wealth, rests on extraneous maintained assumptions, such as monopoly power or scale economies. Such arguments are not uncontested.[13] Certainly the present results lend no support to the monopolization thesis, and cannot overturn Adelman's contention that "Braun's argument that monopolization of landholding allowed estate owners to earn absolute rents is empirically unfounded" (Adelman 1994, 92n).

4.3. The investment advantages of land concentration and ownership

We now confront the third major hypothesis in the traditional literature. Here, the above assertion that *latifundia* might have benefited from scale economies and monopoly power which would have enhanced land values is joined by a complementary line of argument which suggests other means by which owners of large estates were advantaged in the agrarian system of the day: by dint of ownership, wealth (including land as collateral), and a privileged position in society's hierarchy, the *latifundistas* allegedly enjoyed preferential access to credit.

The banking system, it is suggested, was biased toward making large-scale loans. Branch banking was geographically restricted. Massive failures in the Banco de la Provincia de Buenos Aires eviscerated rural branch banking in the financial maelstrom following the Baring crisis of 1890. Such a scenario, it is claimed, handicapped small operators on the pampas, but not the landed elite who could still borrow through their banking contacts in the city of Buenos Aires.[14] Evidence on the distribution of bank loans suggests that small-scale operators in remote rural agriculture stood at the bottom of the pecking order: first, lending was heaviest in non-agricultural sectors; second, within agriculture the bulk of lending was disbursed in relatively large tranches; and third, across the province the expansion of credit was weakest in the south and west, the very regions experiencing new agricultural expansion—that is, where one might expect agricultural lending to new farms to be strongest (Adelman 1994, 196–205). However, such evidence is indirect and an imperfect barometer of rural capital-market failures in the form of lending biases. Adelman (1994, chap. 6) notes several problems. First, lending was measured only for official banks, and does not represent total bank credit. Second, the raw data do not disentangle demand and supply effects: tenants were necessarily less credit-worthy than owners, and tenants (especially sharecroppers) also had less incentive to engage in long-term investment, a classic stylized fact in the economic development literature. Third, the raw data cannot refute the claim that lending was simply chasing the highest expected returns, and that these were not in agriculture, and especially not in high-risk tenant farming (Adelman 1994, 200–201).

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[13] Adelman (1994, 92) cites a proponent of the monopolization thesis in Oscar Braun (1974), and an opponent in Guillermo Flichman (1970).

[14] In particular banks failed to reach tenants, leading to what Adelman calls a "two-tiered structure of rural finance" (Adelman, chap. 6), where small-scale lending was informal, and rested on the ability and willingness of merchants and implement dealers to extend credit. The raw data presented by Adelman lend some credence to this hypothesis. In the 1895 census there were only 51 banks in the province (outside the federal capital), 9 of them in La Plata, and 28 in the long-settled northern *partidos*; only 13 were in the central *partidos*, and 10 in the southern *partidos*, with 4 in Bahía Blanca alone (p. 195).

The difficulties we confront suggest we look at capital market failure from a rather different perspective. Instead of focusing on bank credit activity, it might be useful to examine actual investment outcomes, the ostensible purpose of the credit system. After all, the argument goes, it was not the alleged biased lending or a capital market distortion in and of itself that benefited the *latifundistas*: rather it was what they were able to do with that preferential access to credit, namely engage in productive and profitable investments that were beyond the scope of the disadvantaged tenants. A direct test of this hypothesis is certainly feasible, and a more telling indicator of capital-market failure. Accordingly I ask whether the data reveal any tendency for tenants to systematically invest less than owners, *ceteris paribus*. We may note, in passing, however, that this is a joint hypothesis test, for not only could capital market inefficiencies disadvantage tenants, so too could incentives in the tenant contract system, and so could the higher risks of tenant farming.

4.3.1. Investment in stocks with scale and tenancy effects

A first stab at the question may be made using the *partido*-level data in Latzina's study, which include information on investment activity in stocks, to wit, animal holdings of sheep, cows and horses. The results in Table 6 explore the hypothesis that such stocks of capital were affected by tenancy, as would be suggested by the traditional hypothesis of capital market bias.[15]

Important determinants of stocks seem to be the geographical effects (distant areas without railroads have more animals per unit area). Though not significant, the labor supply proxy has the anticipated sign: an abundance of workers to tend animals led to higher animal stocks. Scale effects are weak, having significance only in the case of sheep grazing, as one might expect. The real interest, for our exercise, is the impact of tenancy on investment: the results are mixed, and cannot be said to offer strong support for the traditional view. The renters appear to invest significantly less in cattle; that aside, the results say tenancy did not matter for the accumulation of animal capital. In some cases the cash and share tenants appear to invest more, sometimes less, but the hypothesis that these effects are non-zero can be rejected at conventional significance levels.

It would be unfortunate, however, if this were our only evidence, as it is only at the *partido* level of aggregation, a limitation of Latzina's data. By focusing on animal stocks we are examining an arena of economic activity known to be dominated by ranchers, with cash and share tenants of marginal import: perhaps that explains why tenancy effects have little explanatory power? The results are informative, suggestive, but inconclusive. The real test of the hypothesis has to center on the hub of the tenant farmer economy: the cultivation of cereals and the use of implements.

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[15] The dependent variables are the log levels of animals per hectare. Control variables, in addition to tenancy measures for each *partido*, include scale effects (log total crop area per unit), geographical and transportation cost effects (log distance to Buenos Aires, railroad dummy and an interaction), a labor supply proxy (log population density), and a measure of financial development (a dummy for the presence of a bank in the *partido*).

4.3.2. Investment in equipment with scale and tenancy effects

We are fortunate now to have Jeremy Adelman's (1994) exhaustive manuscript-level sample from the 1895 national census. This data set is ideal for exploring investment activity at the level of the individual unit for a very large sample (over 1,400 units) of considerable variety. I have coded this information for computational use. The sample includes units of all tenancy types, and a wide range of scales, from units under 10 hectares to units of several thousand hectares, as can be seen from the sample statistics in Table 7.[16]

Even in aggregation the dataset holds some surprises. Figure 2 shows the intensity of implement use for plows, reapers and harrows in the three regions of the province by tenancy type.[17] On first glance, it appears that the data do not conform to the traditional view, in that there is no clear ranking of implement use as expected. If owners had capital market advantages, it was not reflected in uniformly greater use of implements per unit area. Nor were sharecroppers at the bottom of the pile, as incentive and risk effects might suggest. In the north, renters and sharecroppers often exceed owners in implement use; in the center the results are more in line with expectations; in the south, again, the tenancy effects are unclear.

Such averaging is, however, misleading, in that it obscures scale effects: if tenants worked smaller units, and if there were diminishing returns in the use of machinery, we might indeed expect higher levels of equipment per hectare on the smaller tenant units than on the larger owner units. Figure 3 tries to control for scale effects. As expected, diminishing returns are apparent: equipment use per hectare diminishes with scale. But here again, the tenancy effects are not so clear: the traditional view would expect a higher level of investment by owners in every scale category for each implement type in every region. That criterion is clearly not met in the real data.

We have just about reached the limit of two-dimensional graphical analysis at this point, and it is natural to move to an econometric specification. This will allow us to control for some omitted variables not featured in the graphs, and will move beyond region-level averaging. Table 8, columns 1 to 3, relates the log level of plows, harrows, and reapers per hectare on each unit to the characteristics of each unit. using OLS estimation The results are favorable to the hypothesis of investment bias due to tenancy. Consistent with theory, renters use less capital than owners, and sharecroppers use even less. Cash tenants (sharecroppers) use 8% (14%) fewer plows, 15% (18%) fewer harrows, and 16% (30%) fewer reapers. Still, the results are suspect because they are based on a nonrandom, truncated sample. (By taking log of plows per

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[16] The data are not perfect, in that the 1895 census was riddled with errors and inconsistencies on the part of census takers, and this led Adelman to fall short of his ideal or target 1 in 3 sampling of his selected twelve *partidos*. Nonetheless, this dataset is unprecedented in terms of its size, scope, and detail, and, hence, information on micro-level activity in the pampa arable economy of the 1890s.

[17] The data also includes information on threshers, but these were extremely rare in the province, reflecting a general reliance on custom traveling threshing outfits during the period—accordingly, no discussion of thresher use will be pursued, this being an implement widely leased or shared. Indeed, even the results on reapers presented below warrant cautious interpretation given the possibility of reaper sharing, an idea which has caused sufficient controversy in American economic history (David 1966; Olmstead 1975).

hectare we exclude datapoints with a zero equipment entry: log is minus infinity.) This could severely bias our results since the variables do not satisfy OLS assumptions. The truncation excludes 219 data points with zero plows (687 points have zero reapers, and 861 points—more than half the sample—have zero harrows). One way around this is to run the regression with a dependent variable of number of plows—but we are not yet done, for then the data are no longer truncated, but they are still censored: the dependent variable is nonnormal in its distribution, since we cannot observe fewer than zero machines, and we have considerable probability weight at this censoring point. The regression residuals are nonnormal in form and the specification again violates OLS assumptions. I rectify this problem by using a censored regression (tobit) maximum-likelihood approach to estimate the same model. These results appear in columns 4 to 6.

In summary, the correctly-specified tobit results for equipment investment offer no firm support for the traditional view that tenancy mattered for investment outcomes, since most tenancy effects are not statistically significant, though they are signed so as to suggest that tenants were at some disadvantage relative to owners. The only (marginally) significant tenancy effects are those for reapers, but these large pieces of machinery are subject to sharing across plots, as in American experience (David 1966, Olmstead 1975).[18] However, the evidence should be considered tentative, and in need of further corroboration through continued research. Several caveats need to be mentioned. First, this is a joint hypothesis test, and in the case of sharecroppers, the incentive effects in the contract could well have been sufficient in and of themselves to depress investment incentives by the measured amounts. Second, if we confine attention to renters, the impacts are relatively small (cash-lease tenants achieve about 80%–90% of owner capital-stock levels) and of only marginal significance. Is this a sign of failure, or rather a striking success? There may be room for optimism: can such a difference be considered large by the standards of other historical and contemporary cases of tenant versus owner investment effects? Third, what of the benefits of tenancy in terms of reduced monitoring costs—if owners have principal-agent problems enforcing optimal labor effort, they face a higher true opportunity cost of labor than tenants, and might well therefore be expected to substitute some capital for that costlier labor.[19] Fourth, what of equipment sharing? The example of reaper sharing in the midwest cautions us not to make hasty inferences about ownership and use of large implements. For plows and harrows, though obstacles to ownership were smaller, the costs of sharing were probably lower. The tenancy effects for plows and harrows fail conventional significance tests. By dint of such considerations, this observed investment effect for tenants may be viewed as surprisingly small. What mattered more for

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[18] My tobit estimates say that the sign of the tenancy effects is indeed negative. The estimated effects are not trivial: for example, the sample reveals an average of 3.8 plows in units with nonzero plows, with a renter effect of –0.7, and a sharecropper effect of –0.4 (tenant/owner investment ratios of about 80%–90%). For reapers, the same average is 1.9 per unit, with renters –0.3, sharecroppers –0.8 (tenant/owner ratios of 60%–80%); for harrows, the average is 2.2 per unit, with renters –0.5 and sharecroppers –1.2 (tenant/owner ratios of 45%–80%).

[19] They might also substitute land—i.e., seek to spread the monitoring cost over a larger holding. This, for example, was the preferred approach on Spanish *latifundia*. Large plots were rented out to lower transaction costs. In the end, these large-scale tenants often became landowners themselves (James Simpson, personal communication).

investment choices were location, crop mix, and scale. Thus, the investment-bias hypothesis may have power if it can be more precisely estimated: at present, though, it cannot be considered to have been empirically validated in a robust fashion.

5. IMPLICATIONS AND INTERPRETATIONS

What can we learn from these empirical findings? In the introduction I began by aiming to bring quantitative methods to bear on the question of whether the *latifundia* constituted an impediment to economic development in Argentina. By extension, the work could be carried over to address the same question in other parts of Latin America. For the entire region, the historiography is full of declamations concerning the alleged adverse, inequitable, and undesirable consequences of colonial and post-colonial agrarian institutions. However, the complaints are diffuse and hard to form into coherent testable implications. Thus, I am left to formulate my own hypotheses, which I do in such a way as to be consistent with two goals: first, to formulate tests of what I see as predictions of the traditional view; and second, to ensure the tests can be operationalized given the constraints on data availability. The latter concern is non-trivial, since I believe that any assessment of these institutions must be performed at the microeconomic level of farm operations. Yet, the only extant data contains no information on farm level outputs, precluding any direct measurements of productivity on different units, creating a need for more indirect tests of differences in levels efficiency and choice of technique among the various groups on the pampas, owners, cash tenants, and sharecroppers.

Thus, I reduce my attention to three distinct hypotheses in the paper, all of which appear in some guise in the traditional anti-*latifundia* argument:

1. Land distribution became more concentrated over time, possibly creating monopolistic land markets. This was to the detriment of tenants who could no longer obtain access to land inputs on "optimal" terms.

2. Such concentration of land was a wealth-enhancing strategy for land owners who profited from owning and operating large units by dint of scale economies, and or land monopoly. Tenants eked out an existence on small units, and never got access to such large land holdings, and thus suffered by never approaching an "optimal" efficient scale of operations.

3. Owners of large landholdings were further advantaged by the privileged position that wealth and influence, and land collateral, brought them in credit markets. In contrast, tenants faced credit constraints or credit rationing, and so could not achieve "optimal" levels of investment or capital inputs.

Clearly, these are translations of historians' critiques into microeconomic language amenable to econometric testing. All of the hypotheses take essentially the same form: they assert that, compared to the landowners, tenants faced some sorts of constraints in their agricultural operations which deprived them of realizing the same level of efficiency, profitability, or productivity. Thus, land concentration allegedly

constrained tenants to suboptimal choices of the land input, credit market failures supposedly resulted in tenants making suboptimal investments, and these or any number of other constraints contributed to a lower level of efficiency on tenant farms. So it was, perhaps, that tenant farmers could never "advance" or "move up the agricultural ladder" relative to the owners: they were forever engaged in a losing game, the odds stacked against them. Constrained to inevitably lower profits, the distribution of income, and thus wealth and power, was sure to never turn in their favor.

It is worth taking a moment to clarify this argument in simple production-function terms. Let us suppose that agricultural revenues Y, depend on a production function f which takes as its arguments the level of technology (or efficiency, or factor productivity) T, land area input A, capital input K, and labor input L. Let the producer price be P. We would write

$$Y = P\, f(T,A,K,L),$$

where f is increasing in every argument. Essentially, the narrowly-specified economic case against the latifundia revolves around the peculiar advantages they enjoyed in the application of this technology. This could take several forms, meaning an advantage in any of the dimensions P or T or A or K or L.

It is easy to reject a claim of advantage in terms of final market price P. The goods produced were homogeneous products, sold for transportation to the port to the same merchants and handled by the same railroads. This is not to say that farmers did not have complaints against price-gouging by the railroads (like farmers everywhere at the time), nor does it rule out some possible advantage to large producers who might negotiate lower contract rates for freight movement. But this is, all considered, a second order problem and far from the core of the case against the *latifundia*. It is also predicated on the idea that tenants were confined to small scale production, could not pool resources to send shipments at a cheaper rate, and numerous other assumptions. Therefore, I ultimately reject a discussion of the price P as a source of differences among operators (notwithstanding the incentive effects of the implicit price faced by sharecroppers, which is discussed below). Rather, I focus on the four inputs: technology T, land A, capital K, and labor L.

It is next somewhat easy to dismiss differences in labor input L. Both tenants and owners faced an extremely fluid external labor market that yielded a given wage rate for any external labor supply that was needed, and one cannot see how such a supply was not constrained in any way. Moreover, it is hard not to escape the conclusion that in the dimension of the labor input L, tenants actually had considerable efficiency and productivity advantages over owners, especially the cash tenants who faced no labor-supply disincentives due to sharecropping incentives. After all, tenants were supplying their own labor. They faced no principal-agent problems and no monitoring costs, so that the effective labor input of the tenant was surely greater than that of an owner-operators hired hand. Hence, in seeking to differentiate tenants from owners, and show the former as economically disadvantaged, we are forced to shift the ground of the debate to the three remaining inputs: land, capital, and technology. Fortunately, it is to these three concerns that my data and empirical tests speak.

First, on land input A, according to the conventional wisdom, we expect to see increased concentration of land holdings over time, and in cross section, evidence that tenants are marginalized on smaller units. We should certainly hope to detect statistically significant differences in the size of plots used by tenants and owners, with the tenants constrained, and thus below some efficient scale of operation. This is not the case. Land holdings appear to subdivide over time in the *partidos* for which we have data. And at the unit level it is not possible to find any statistically significant difference in the mean or median plot used by cash tenants, sharecroppers, and owners. There are some differences in other aspects of the distribution of land in each group (the size distribution of plots has higher variance for owners), but the measures of center suggest that, if anything, tenants owned slightly larger units than owners. It is easy to argue that a tenant could not get access to a plot large enough, but nonsensical to say there were impediments to renting a plot small enough, and thus we are forced to discount differences on the land input dimension as a source of tenant disadvantage. So let us from now on consider the choice of technique for tenants and owners on a plot of the same fixed size A. The key issues is this: could tenants do as well with this plot as owners?

We are left with two dimensions for distinctions between what tenants could do and what owners could do: the efficiency or technology parameter T, and the capital input K. Could tenants still be worse off as a result of constraints in these dimensions? I will argue that given my results, we cannot draw such a conclusion. Let us assume that they were worse off, and I will try to obtain a contradiction. It must be the case, if there are no detectable differences in the P or L or A dimesnions, that tenant disadvantage takes one of three forms, *ceteris paribus*:

(a) $K(\text{owner}) > K(\text{tenant})$ and $T(\text{owner}) > T(\text{tenant})$

(b) $K(\text{owner}) > K(\text{tenant})$ and $T(\text{tenant}) \geq T(\text{tenant})$

(c) $K(\text{tenant}) \geq K(\text{owner})$ and $T(\text{owner}) > T(\text{tenant})$

In the last case the tenant is constrained by a lower level of efficiency, and in the second case by an investment constraint. In the first case, the tenant is constrained in both ways. However, our results on investment contradict the claims about investment constraints in (a) and (b). Result (c) is still possible, but in doubt. Since there are no differences in scale between tenants and owners, it is hard to ascribe these efficiency differences to any other attribute of agricultural operations. The conventional scale-effect argument has already fallen with the finding that mean or median plot size did not vary with tenancy status. Moreover, if true, case (c) would not so much be ammunition for a case against the *latifundia*, for, on efficiency grounds it would argue that owners ought to have taken over the entire body of operations since, despite no disadvantages on the dimensions of land input, capital input, or producer price, still tenants were unable to farm as efficiently. This case also turns on its head the conventional arguments about the desirability of land reform to favor small-scale operators and former tenants. The remaining possibility is that tenants were somehow disadvantaged in other ways we cannot yet measure, and it seems reasonable to admit

that this is still a real possibility. Perhaps in terms of knowledge, connection, or even just contractually (especially in the case of sharecroppers) we might expect lower efficiency outcomes for tenants. Thus, modern proponents of land reform do not suggest mere redistribution: "What must be stressed, however, are the essential additional public inputs required for any distributive policy to be effective. Reallocation alone will not work. It needs to be viewed as a means toward the end of greater efficiency and output" (Fishlow 1996, 8). However, the hypothetical claim that tenants would achieve such higher efficiency in a post-reform world, and sufficiently high to offset the public spending costs, makes this a much weakened position from which to attack the *latifundia*.

However, an alternative line of reasoning is suggested by the consideration that we may drop our current maintained assumption. This introduces a fourth and final set of inequalities as a possibility:

(d) $K(\text{tenant}) \geq K(\text{owner})$ and $T(\text{tenant}) \geq T(\text{owner})$

Now, we no longer assume that the tenant faces any disadvantage, and may achieve, or even exceed, the technology and capital input levels of the owners. Yet in this conclusion, the conventional case against the *latifundia* once more dissolves. After all, if the tenant now faces no disadvantage on any dimension, and can pursue profitable agricultural operations on equal or even better terms than the owner, what case is left to answer? In this world, the tenant farmer is the great success story, and can compete at least as well as the owner operators in agricultural operations. There is even tentative evidence in favor of this conclusion. After all we found no significant investment effects constraining tenants at lower capital input levels. (I say the evidence is tentative because the point estimates were still negative.) This would have to be viewed as a surprising conclusion, especially for sharecroppers, where the adverse implications of the share contract would already lead us to expect bias *in favor* of finding lower investment on sharecropped units: because the effective producer price is diminished to a sharecropper by the fraction of crop retained, the effective marginal product of capital is also diminished, leading, one would suspect, to lower capital inputs on the same land parcel. Since land parcels did not differ in size across tenancy groups, this amounts to testing for differences in capital use. Yet even with theoretical grounds for such a bias, we still cannot obtain a significant negative capital effect on equipment, except on large, shared (or leased) machinery such as reapers.

In summary, the range of results presented in this paper, whilst perhaps at first sight appearing scattered and leading in different directions, do, in the aggregate, enable us to delineate quite cleanly the range of possible differences in the choices of technique and constraints facing the various operators, both owners and tenants. By considering such differences in a standard production-function approach it is difficult to conclude that tenants faced a major disadvantage in any of the measurable dimensions here examined. Instead, the tenants seem to have been informed, efficient, profit-maximizing operators, well-able to compete against their landowning rivals.

6. CONCLUSION

The situation of tenant farmers in post-colonial Latin America has generally been viewed in a pessimistic light. The *latifundia* are usually seen as having been an obstacle to progress, allowing owners to accumulate wealth and power, and constraining the choices available to the landless agricultural workers. The Argentine case has widely been considered to fit this general picture, albeit with certain specific differences. The quotations highlighted in the introduction are not unusual as declamations of the Argentine system of land tenure.

This paper has attempted a fresh attack on the question via a quantitative analysis of agricultural operations in the pampas of the late nineteenth century, to try to assess some of the (implicit) economic assumptions embedded in the traditional, pessimistic view. Given the widespread acceptance of this view, and the breadth and quantity of evidence available to me, I anticipated robust and clear-cut evidence to support the case against the *latifundia*. I expected to write a paper detailing in quantitative economic terms the many and varied disadvantages faced by the tenants on the pampas. Yet that paper proved impossible to write. I found that only the weakest evidence can be assembled to suggest that the large-scale landowners gained any advantage relative to tenants either directly (by increased land values) or indirectly (via monopoly, or via capital-market imperfections and investment).

My conclusions may come as no surprise, at least to scholars who take a more optimistic view of the *latifundia* system and its alleged economic inefficiencies. Adelman has argued that tenants never really sought land ownership as a final goal, despite the supposedly vexing political issue of land-reform. Tenants, rather, "enjoyed distinct advantages from leasing: major investment was unnecessary and short-term contracts avoided diminishing returns to land" (Adelman 1994, 96).

There are numerous qualifications to add to the empirical story presented here, as noted above, but the main aim has been to shift the direction of debate toward testable quantitative hypotheses, and to show that this is eminently possible in the case of the debate over agrarian institutions and economic outcomes for one important case. The methods are thus novel, but cannot always be set up as one would wish given the paucity of data. For example, one would like output data so as to be able to test directly the efficiency of farms of different scales and tenancy status; and one would like to know whether tenants' freedom to pursue investments was as notable in the case of fixed investments (improvements, buildings, etc.) as in the case of moveable equipment like plows. In these areas, ownership may well have conveyed certain advantages, but that data is simply not available at present.

For the moment, I have found little to distinguish the operations in tenant-operated farms from those in owner-operated farms, bolstering the view that tenants faced few problems in competing in technique with owners. One is forced to question, then, whether tenants operated under the kind of miserable conditions so frequently described in contemporary narratives and recent historical writings, or, instead, pursued the tenant lifestyle as an efficient enterprise and a profitable pursuit. It appears tenants were doing the best they could, and doing about as well as their landowning competitors. Since the long-run impact of the *latifundia* is tied up with so much else, such as the implications of wealth distribution for political change and

economic development, I cannot offer a macro-institutional defense of the institution. Indeed, there may not be a defense if the institution is considered part and parcel of Latin American inequality. But such a condemnation of *latifundia* outsteps its institutional definition, and I think my micro-institutional focus is certainly a good place to examine the inner workings of the institution itself. The results are provocative enough even so. The notion that land and opportunities were no less accessible for tenants, coupled with the flexibility conferred by a lease contract, firmly accords with a very different and optimistic view of tenant farming on the pampas, for example, as described by Ferns:

> Given the abundance of land, the cereal farmers quickly abandoned the romantic notion of the colonisers, who thought in terms of planting a race of self-sufficient peasants working away at the production of fruit, poultry, milk, cheese and breadstuffs. As soon as wheat became a big cash crop the Argentine farmer went for extensive cultivation. Once he began to plant large areas, which he could still do by hand, he was obliged to harvest and thresh with modern machines. Again capital was needed. Long before the modern businessman had discovered the wisdom of renting equipment as a means of economising on capital, the Argentine cereal farmer had discovered the advantages of renting. He rented everything: land and machines. For him the goal was the big crop sold for cash as quickly as possible. The picture of the Argentine farmer as a share-cropping slave without home and without property is a false one. His object was money: to get in and get out, and more often than not he got in with nothing and he got out with something. (Ferns 1973, 61–62)

Indeed, tenants may have been even better placed than the landed oligarchs in some ways. The revisionist claims are not uncontroversial, but the challenge to validate the case against the latifundia in quantitative terms remains to be made.

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Table 1
Change in Land Distribution in Three Partidos

	%Units in category								
	Baradero			Nueve de Julio			General Villegas		
Scale (hectares)	1864	1890	1920	1864	1890	1920	1864	1890	1920
0–1,000	14.0	26.4	84.4*	0.2	1.0	33.4			15.7
1,001–2,500	23.6	22.9	12.0	2.5	8.5	22.8*		0.4	14.1
2,501–5,000	5.5	26.5*	3.6	1.6	21.2	18.1		3.6	17.1
5,001–10,000	22.0*	24.2		33.2	42.4*	15.1		23.0	22.2*
10,001–20,000	34.9			29.4*	17.5	10.6		38.9*	23.3
Over 20,000				3.6	10.1			34.1	7.6
Other (fiscal land)				29.0					

* denotes median scale category.
Source: Cortés Conde (1979, 114).

Table 2
Change in Land Distribution in Buenos Aires Province

Scale (hectares)	1901 counts	1911 counts	% change in counts	1901 shares	1911 shares	% change in shares
10–25	8,336	14,001	68%	21%	23%	7%
26–50	8,856	14,191	60%	22%	23%	2%
51–100	5,703	9,248	62%	14%	15%	3%
101–200	4,593	7,466	63%	12%	12%	3%
201–300	1,794	3,850	115%	5%	6%	36%
301–650	2,949	4,948	68%	7%	8%	7%
651–1,250	2,161	3,256	51%	5%	5%	-4%
1,251–2,500	2,070	2,530	22%	5%	4%	-22%
2,501–5,000	1,581	1,649	4%	4%	3%	-34%
5,001–10,000	964	682	-29%	2%	1%	-55%
Over 10,000	486	306	-37%	1%	0%	-60%
Total	39,493	62,127	57%	100%	100%	

Source: Adelman (1994, 92).

Table 3
Scale and Tenancy in Adelman's 1895 Census Subsample

	1	2
Dependent variable is:	Ln Area	Ln Area
Variable	Coefficient t-ratio	Coefficient t-ratio
Constant	1.799 (85.60)	1.536 (37.00)
Rent	0.109 (3.72)	0.007 (0.27)
Share	0.173 (3.78)	0.140 (3.34)
Wheat/Area		0.326 (7.48)
Corn/Area		-0.020 (0.44)
Alfalfa/Area		-0.624 (6.55)
Chivilcoy		0.267 (6.70)
Pergamino		0.281 (5.45)
Junin		0.591 (10.80)
Bolívar		0.487 (8.24)
Olavarría		0.064 (1.23)
Tandil		0.045 (0.75)
Pringles		0.328 (5.48)
Tres Arroyos		0.380 (6.63)
Suárez		0.360 (4.78)
Guaminí		1.141 (11.00)
Alsina		0.424 (4.51)
NOBS	1454	1437
R squared adjusted	.01	.23
SEE	0.526	0.463

Notes: Based on a cross-section of units in twelve *partidos*. See Table 7 for sample statistics. See text.
Source: Adelman (1994).

Table 4
Value and Scale Effects in Latzina's 1888 Cross Section

Dependent variable is:	1 Ln LandValue	2 Ln LandValue	3 Ln LandValue
Variable	Coefficient t-ratio	Coefficient t-ratio	Coefficient t-ratio
Constant	5.369 (8.56)	5.588 (8.52)	4.736 (2.97)
Ln Crop Area/Unit	-0.092 (1.43)	-0.135 (1.76)	-0.120 (1.48)
Ln Population Density	0.547 (6.39)	0.490 (4.20)	0.502 (4.22)
Ln Distance to BA	-0.396 (3.48)	-0.394 (3.30)	-0.242 (0.85)
Railroad Dummy	0.161 (0.89)	0.197 (1.05)	0.994 (0.73)
Railroad × Ln Dist.			-0.151 (0.59)
Distance NW of BA		0.0007 (1.25)	0.0006 (1.13)
Distance SW of BA		-0.0003 (0.29)	-0.0004 (0.42)
NOBS	73	73	73
R squared adjusted	.85	.85	.84
SEE	0.561	0.561	0.564
Ln Crop Area/Unit Endogeneity (p val.)	0.35	—	—

Notes: BA=Buenos Aires. Based on a cross-section of *partidos*. See text.
Source: Latzina (1888).

Table 5
Value and Scale Effects in Adelman's 1886–1941 Probate Sample

Dependent variable is:	1 Ln Value	2 Ln Value	3 Ln Value
Variable	Coeff. t-ratio	Coeff. t-ratio	Coeff. t-ratio
Constant	-99.29 (7.56)	-100.42 (7.73)	-66.50 (2.76)
Year	0.06 (8.38)	0.06 (8.49)	0.04 (3.09)
Center	-0.02 (0.09)		
South	0.35 (1.02)		
LnDist to BA	-0.74 (5.09)	-0.75 (5.22)	-0.81 (5.53)
LnDist to BA ×(Yr>1907)			0.10 (1.67)
LnLand	0.0242 (0.29)	0.0607 (0.69)	0.0816 (0.93)
Distance NW of BA		0.0009 (1.60)	0.0010 (1.83)
Distance SW of BA		0.0007 (0.89)	0.0009 (1.03)
NOBS	77	77	77
R squared adjusted	.65	.65	.66
SEE	0.662	0.667	0.290
LnLand Endogeneity (p value)	0.46	0.82	0.71

Notes: Based on a cross-section of *partidos*. See text.
Source: Adelman (1994).

Table 6
Investment in Stocks with Scale and Tenancy Effects in Latzina's 1888 Cross Section

	1		2		3	
Dependent variable is:	Ln Sheep/Area		Ln Horses/Area		Ln Cattle/Area	
Variable	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Constant	3.23	(2.48)	1.68	(2.59)	3.21	(4.89)
Ln Total Crop Area/Unit	0.23	(1.76)	0.02	(0.28)	-0.05	(0.81)
Banks Dummy	-0.15	(1.08)	-0.04	(0.57)	-0.01	(0.11)
Rent Units/Units	-0.25	(0.49)	0.14	(0.54)	-0.44	(1.68)
Share Units/Units	1.02	(1.13)	0.76	(1.68)	0.37	(0.81)
Ln PopDensity	0.32	(1.70)	0.17	(1.84)	0.01	(0.14)
Ln Distance to BA	-0.57	(1.08)	-0.48	(1.85)	-0.67	(2.54)
Railroad Dummy	-2.93	(2.75)	-0.99	(1.86)	-1.06	(1.98)
Railroad ×Ln Dist. to BA	1.28	(2.81)	0.44	(1.92)	0.46	(2.02)
NOBS	87		87		87	
R squared adjusted	.26		.33		.25	
SEE	0.488		0.243		0.246	

Notes: Based on a cross-section of *partidos*. See text.
Source: Latzina (1888).

Table 7
Sample Statistics for Adelman's 1895 Census Subsample

Series	Obs	Mean	Std Dev	Minimum	Maximum	Median
Area	1459	156.05	498.72	0	14,000	80.00
Wheat	1464	42.09	110.97	0	1,872	6.24
Corn	1464	33.93	55.82	0	780	15.60
Alfalfa	1464	6.97	79.24	0	2,100	0.00
Plows	1464	3.24	5.56	0	110	2.00
Reapers	1464	1.01	2.03	0	28	1
Harrows	1464	0.93	2.62	0	80	0
Threshers	1464	0.06	0.31	0	5	0
Own	1461	0.43	0.50	0	1	0
Rent	1461	0.45	0.50	0	1	0
Share	1461	0.11	0.32	0	1	0
Baradero	1464	0.16	0.37	0	1	0
Chivilcoy	1464	0.23	0.42	0	1	0
Pergamino	1464	0.09	0.29	0	1	0
Junin	1464	0.07	0.26	0	1	0
Bolívar	1464	0.06	0.24	0	1	0
Olavarría	1464	0.10	0.30	0	1	0
Tandil	1464	0.06	0.24	0	1	0
Pringles	1464	0.07	0.25	0	1	0
Tres Arroyos	1464	0.08	0.27	0	1	0
Suárez	1464	0.04	0.19	0	1	0
Guaminí	1464	0.02	0.12	0	1	0
Alsina	1464	0.02	0.14	0	1	0
Plow/Area	1457	0.05	0.08	0.00	1.00	0.00
Reapers/Area	1457	0.01	0.05	0.00	1.00	0.00
Harrows/Area	1457	0.02	0.11	0.00	4.00	0.00
Threshers/Area	1457	0.00	0.01	0.00	0.16	0.00
Ln(Plow/Area)	1247	-3.43	0.95	-8.43	0.00	-3.45
Ln(Reapers/Area)	778	-4.39	0.90	-9.55	0.00	-4.43
Ln(Harrows/Area)	604	-4.04	1.08	-9.55	1.39	-4.09
Ln(Threshers/Area)	69	-5.45	1.27	-8.30	-1.83	-5.46
Wheat/Area	1457	0.26	0.33	0.00	4.00	0.10
Corn/Area	1457	0.31	0.32	0.00	2.33	0.25
Alfalfa/Area	1457	0.04	0.14	0.00	1.00	0.00

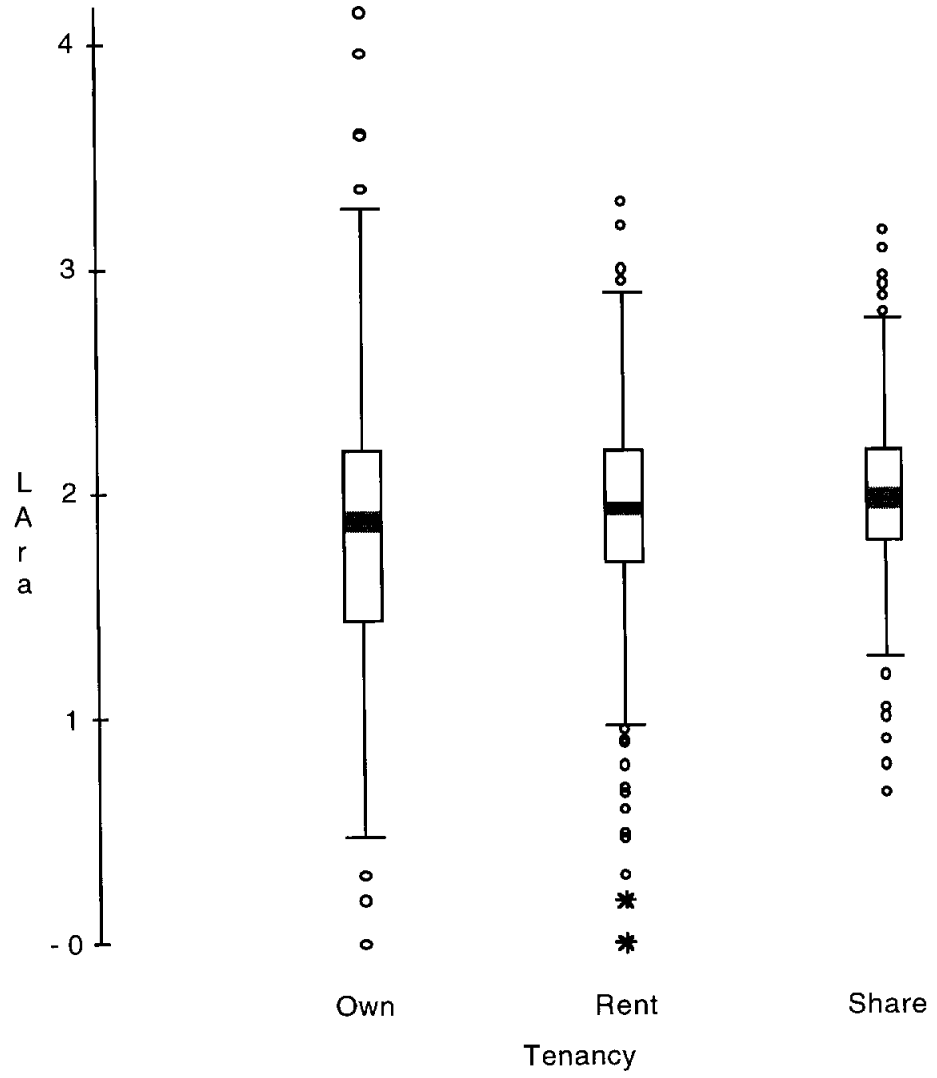
Notes: Area is unit area in hectares. Wheat, Corn, Alfalfa are areas sown to crops in hectares. Plows, Reapers, Harrows, Threshers are counts of equipment. Own, Rent, Share are tenancy dummy variables. Baradero, Chivilcoy, Pergamino, Junin, Bolívar, Olavarría, Tandil, Pringles, Tres Arroyos, Suárez, Guaminí, Alsina are *partido* dummies.
Source: Adelman (1994).

Table 8
Determinants of Intensity of Equipment Use in Adelman's 1895 Census Subsample

Dependent variable	Ln (Plows/ Area)		Ln (Harrows/ Area)		Ln (Reapers/ Area)		Number of Plows		Number of Reapers		Number of Harrows	
Method	OLS		OLS		OLS		Tobit		Tobit		Tobit	
Variable	Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio
Constant	-2.80	(32.70)	-3.47	(28.31)	-3.66	(30.90)	-0.56	(0.81)	-4.95	(8.61)	-2.21	(7.35)
Rent	-0.08	(1.83)	-0.15	(2.26)	-0.16	(3.12)	-0.72	(1.88)	-0.49	(1.30)	-0.27	(1.47)
Share	-0.14	(2.35)	-0.18	(1.60)	-0.30	(4.16)	-0.44	(0.65)	-1.20	(2.05)	-0.84	(2.87)
Chivilcoy	-0.39	(6.19)	-0.21	(2.26)	-0.07	(0.85)	-0.39	(0.51)	1.51	(2.73)	0.89	(3.12)
Pergamino	-0.09	(1.26)	0.29	(2.53)	-0.17	(1.85)	1.50	(1.27)	3.97	(5.45)	1.11	(2.70)
Junin	-0.53	(6.29)	-0.36	(3.10)	-0.02	(0.19)	-0.10	(0.14)	1.00	(1.32)	1.15	(3.24)
Bolívar	-0.58	(6.88)	-0.45	(4.03)	-0.41	(4.28)	0.20	(0.17)	1.82	(2.13)	0.72	(1.43)
Olavarría	-0.55	(4.91)	0.61	(4.27)	0.21	(1.56)	-1.97	(2.08)	3.17	(4.75)	0.58	(1.57)
Tandil	-0.28	(2.55)	0.41	(2.52)	0.39	(2.92)	-1.54	(1.59)	2.75	(3.60)	0.98	(2.80)
Pringles	-0.50	(4.34)	-0.03	(0.26)	0.12	(0.79)	-1.58	(1.55)	2.22	(2.64)	0.40	(0.94)
Tres Arroyos	-0.13	(1.36)	0.48	(3.31)	0.11	(0.90)	2.07	(2.61)	2.42	(3.31)	1.61	(4.69)
Suárez	-0.92	(8.49)	0.06	(0.30)	-0.23	(1.97)	-1.20	(0.97)	0.06	(0.06)	0.85	(1.18)
Guaminí	-1.15	(6.56)	-0.89	(2.98)	-0.99	(3.50)	-2.63	(2.08)	-1.74	(1.49)	-2.17	(4.27)
Alsina	-0.85	(6.08)	-0.88	(6.48)	-0.44	(3.54)	-1.77	(0.82)	-1.72	(1.23)	-0.37	(0.54)
Wheat/Area	0.03	(0.38)	0.11	(1.02)	-0.11	(1.12)	2.71	(5.49)	2.89	(6.04)	2.14	(10.93)
Corn/Area	0.46	(5.48)	0.18	(1.47)	-0.05	(0.56)	3.63	(5.15)	0.88	(1.38)	0.33	(1.05)
Alfalfa/Area	1.40	(6.20)	0.82	(3.63)	1.33	(5.06)	1.69	(1.34)	3.88	(3.18)	2.41	(5.76)
Area	-4e-03	(13.36)	-5e-03	(11.68)	-4e-03	(12.25)	1e-02	(27.74)	7e-03	(10.59)	7e-03	(39.03)
$Area^2$	2e-06	(7.79)	2e-06	(6.19)	2e-06	(7.01)	2e-06	(11.33)	-3e-08	(0.21)	2e-07	(5.65)
$Area^3$	-2e-10	(6.87)	-3e-10	(5.16)	-2e-10	(6.07)	-6e-10	(0.00)	-2e-10	(0.00)	-2e-10	(0.00)
$Area^4$	1e-14	(0.00)	1e-14	(0.00)	9e-15	(0.00)	3e-14	(0.00)	9e-15	(0.00)	1e-14	(0.00)
$\beta_i \neq 0$: p value												
Tenancy effects	.04		.06		.00		.17		.10		.01	
Partido effects	.00		.00		.00		.00		.00		.00	
Crop effects	.00		.00		.00		.00		.00		.00	
Scale effects	.00		.00		.00		.00		.00		.00	
R^2 adjusted	0.51		0.61		0.52		—		—		—	
σ	0.667		0.679		0.629		4.79		3.99		2.32	
Mean dep. var.												
all cases	-3.43		-4.04		-4.39		3.24		0.93		1.01	
cases>0	—		—		—		3.79		2.25		1.90	
NOBS												
all cases	1245		603		777		1460		1455		1458	
cases>0	—		—		—		1245		603		777	

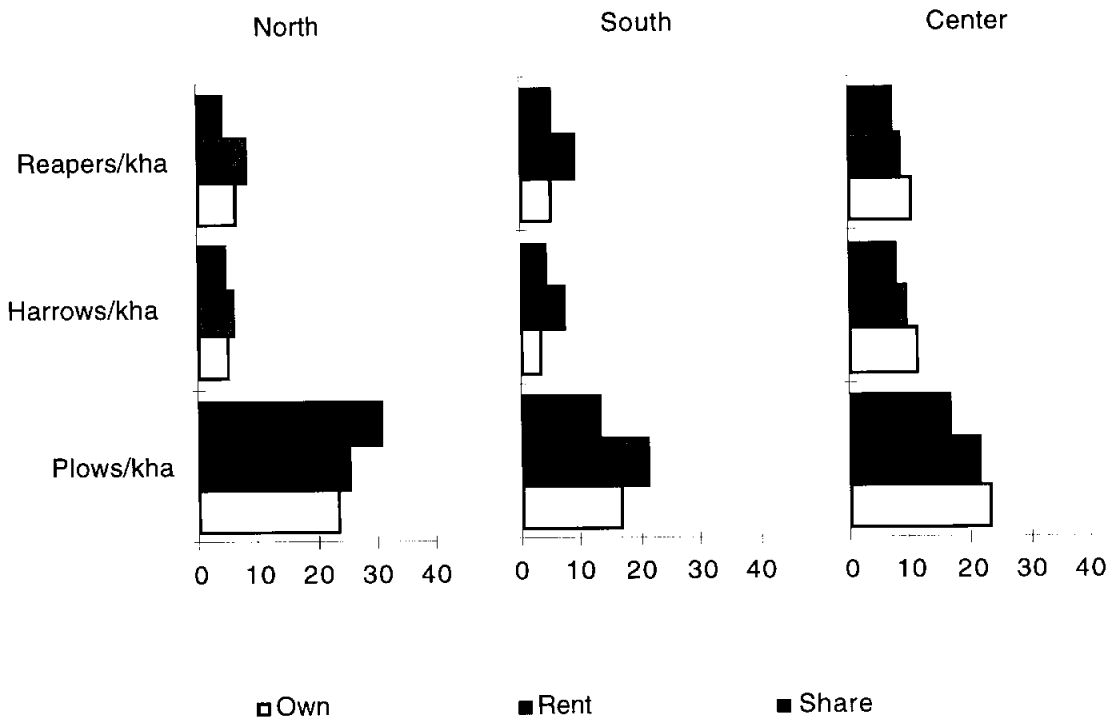
Notes: See text. Tenancy effects tests for nonzero coefficients on Rent, Share. Partido effects tests for nonzero coefficients on Chivilcoy, Pergamino, Junin, Bolívar, Olavarría, Tandil, Pringles, Tres Arroyos, Suárez, Guaminí, Alsina. Crop effects tests for nonzero coefficients on Wheat/Area, Corn/Area, Alfalfa/Area. Tenancy effects tests for nonzero coefficients on Area, $Area^2$, $Area^3$, $Area^4$.
Source: Adelman (1994).

Figure 1
Distirbution of Land by Tenancy in Adelman's 1895 Census Subsample



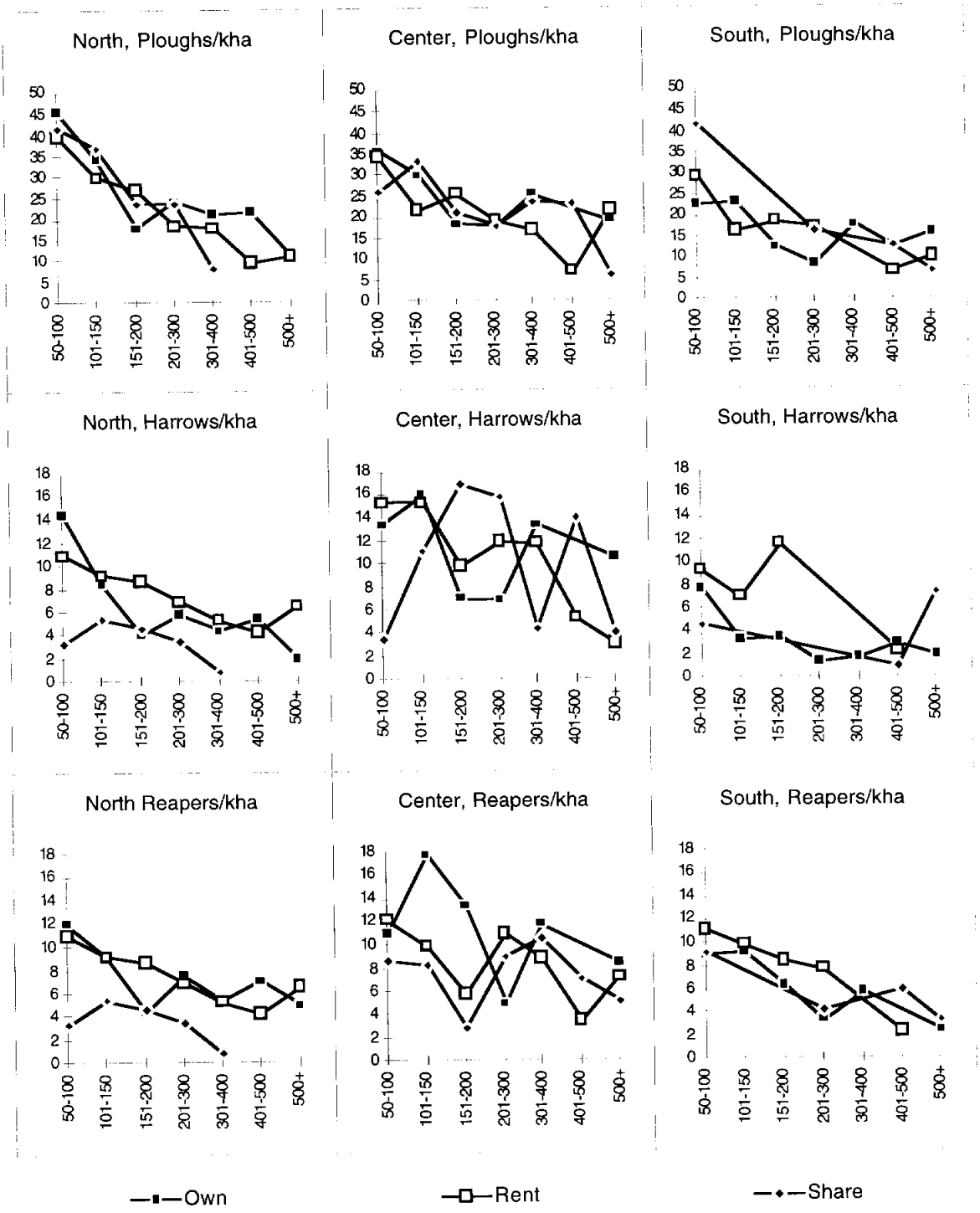
Notes: Vertical Axis: LAra =Ln Land Area. Boxes contain *median* (bar) and its 95% confidence interval (shading). The *hinges* are also shown at the end of the box (hinges are medians of the half samples split by the median). Lines extend to the *adjacent values* (closest observations within the *inner fences*, the latter defined as being 1.5 times the hinge spread outside the hinges). Outside and far outside observations shown by circles and stars, respectively (outside are between the inner fences and the *outer fences*, the latter defined as being 3 times the hinge spread outside the hinges; far outside are outside the outer fences).
Source: Adelman (1994).

Figure 2
Equipment Use by Tenancy and Scale in Adelman's 1895 Census Subsample



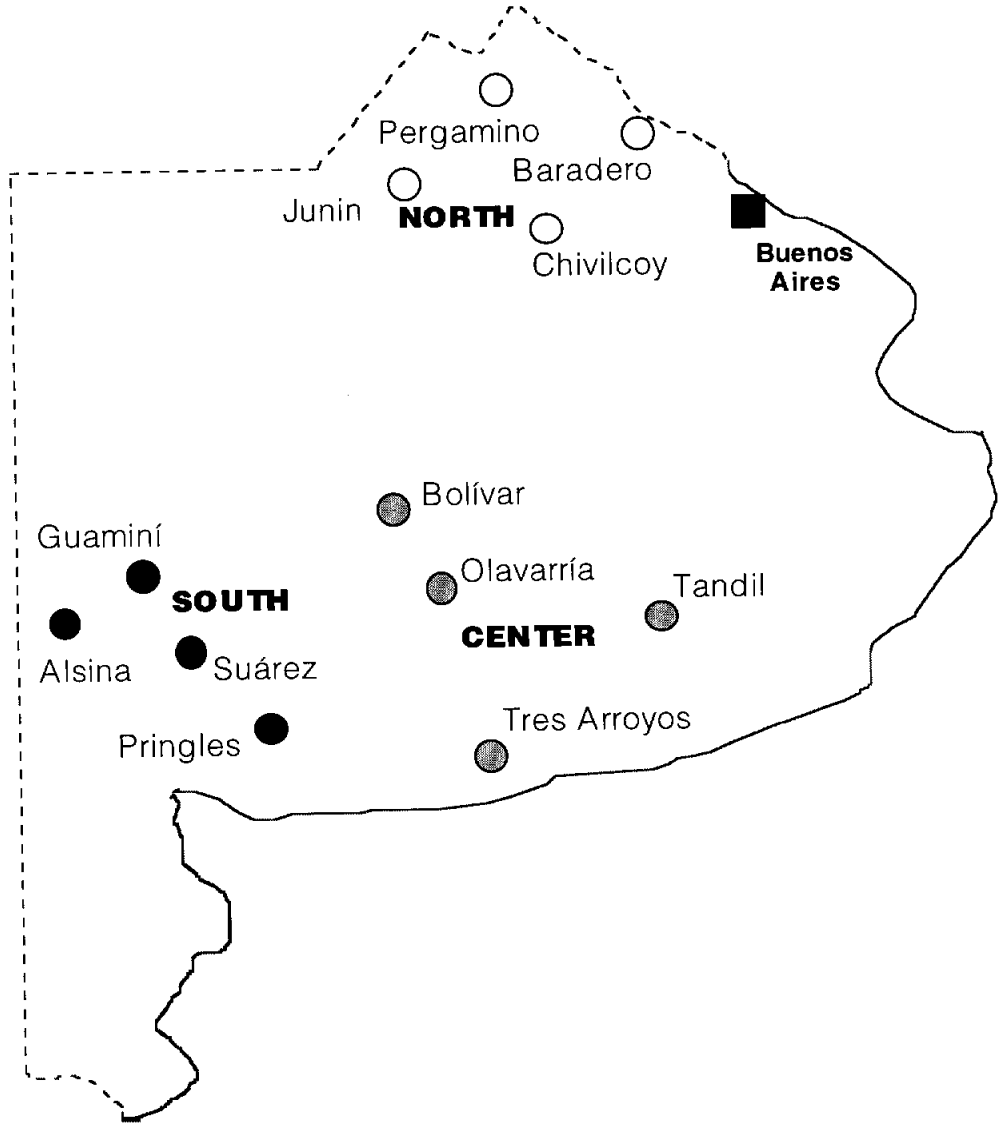
Source: Adelman (1994).

Figure 3
Equipment Use by Region, Tenancy, and Scale in Adelman's 1895 Census Subsample



Notes: Scale categories on the horizontal axis in hectares.
Source: Adelman (1994).

Map 1
The Twelve Partidos of Buenos Aires Province in Adelman's 1895 Census Subsample



Source: Adelman (1994).