Farm Operator Entry and Exit Behavior: A Longitudinal Analysis

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Farm structure is experiencing a persistent change. Since the early 1980s, US farms specializing in crops have constantly declined in number and grown in average size. Crop production has moved to large farms at the expense of small and medium sized farms. This shift in farm structure to more concentrated production is complex. Market forces such as technological change and changing factor input prices are likely contributors as they have been in the past. Another factor that has generated considerable interest is the role of commodity program payments. Commodity payments are tied to a farm's current or historical production. Therefore, larger farms tend to receive the greatest share of commodity program payments. However, the extent that commodity payments have contributed to farm concentration is under debate.

This project proposes to investigate the role farm characteristics, management practices, and government commodity payment programs in farm concentration by studying the entry and exit decisions of farm operators at the county level in the South Dakota. The study will use longitudinal data from the US Agricultural Census to identify farm structures, management practices and individual operator human capital and demographic characteristics. We intend to combine the agricultural census data with regional data on local economic activity, fiscal measures and natural amenities to explain farm producer's entry and exit decisions.

JEL: Q12, J61, J62

I. Introduction

Due to declining economic opportunities, rural parts of the United States have experienced declining population and employment growth. Rural out-migration has been characterized by a persistent loss of farm and nonfarm population to the employment and population growth in metropolitan cities. The demographic group leading the rural out-migration is the young since their longer work horizon allows a greater return to migration. As a consequence, the average age of rural population has increased relative to urban areas.[1] While rural areas have diverse attributes, they have a common economic base. Rural economies are heavily dependent on resource extraction, whether it is agriculture, forestry, fisheries, or mining. US agricultural policy since the 1930s has focused on farm commodity payments to stabilize rural household income. In theory, by stabilizing farm income, the commodity payment program would also stabilize the nonfarm rural economy by stabilizing the number of family farms. The family farm has historically served as the economic base in many rural areas, especially in agriculture dependent counties. A stabile number of family farms are critical to maintain agricultural support industries such as implement, seed, and fertilizer dealers as well as school systems and the retail and service industries in rural areas. Trends in farm structure, however, suggest that commodity payment programs may be undermining the stability of family farms and the rural economy.

<u>The Decline in Small and Medium Farms</u>

Of particular interest in this study is the economic challenge faced by small and medium sized farms and the exit rate faced by these operations. The understanding of small and medium farm net-exit patterns is important since these farms are primarily traditional family farms.[2] Farms with annual sale under $250,000 have significantly higher net-exit rates than larger farm (with sales in excess of $250,000). Consequently, the number of small and medium farms has been falling over time. Since the aggregate amount of US farmland has remained relatively constant over the last 100 years, the higher exit rate for small and medium sized farms leads to a larger average size farm and greater concentration in the farm sector. The number of farms larger than 1000 acres has increased by 16,000 between 1978 and 2002. Seven percent of all farms produced 50% of all agricultural output in 1978, while just 1.5% of all farm produced over 50% of farm output in 2002.

As farms become more concentrated by acreage, they also become more concentrated by sales class. Large farms with sales of $250,000 or more have steadily increased from 4.6% of all farms in 1982 to 8.2% of all farms in 1997. Medium sized farms with between $100,000 and $250,000 of sales increased from 10.7% of all farms in 1982 to 11.2% in 1992. This trend reversed in 1997 as medium sized farms fell to 9.9% of all farms. The largest sales class of small farms with sales of $50,000 to $99,999 (the largest sales class of the small farms) declined from 11.3% in 1982 to 8.3% in 1997. The small farm class with annual sales of $10,000 to $49,000 and less than $10,000 are the largest in number of all farm classifications by sales size (73.4% of all farms in 1997). Their numbers have

[1] The demographic increase in age of the rural population is enhanced by an in-migration of retirees. For a good discussion of rural to urban populations shifts in Canada, see Juno Tremblay, "Rural Youth Migration between 1971 and 1996," Working Paper #44, Statistics Canada, Agricultural Division (February, 2001). For the United States, see Kenneth M. Johnson and Glen V. Fuguitt, "Continuity and Change in Rural Migration Patterns, 1950-1995, Rural Sociology, Vol. 65 (March 2000), pp. 27-50.

[2] The farm net-exit is the number of exits minus the number of entrants. Net-exits are commonly expressed as a rate or a percentage of farms exiting.

remained relatively constant between 1982 and 1997 with the smallest of all farms (sales less than $10,000) increasing from 46.9% to 50.4%. Farms in the two lowest sales categories have the highest exit rates. Their numbers remain relatively constant since they also have the highest entry rate. Yet, these farms are so small that their operations have a relatively insignificant impact on the surrounding local economy.[3]

With growing farm sizes, there are fewer farm families to support the rural economy and sustain the rural population. Moreover, rising labor productivity in agriculture due to technological change has dramatically lessened the need for farm labor, depleting employment opportunities in farm-dependent rural areas and intensifying out-migration. Given the dire tends in farm concentration and continued rural depopulation, US agricultural policy has focused on subsidy programs to stabilize family farm income to help mitigate the declining farm numbers and prop-up the rural economy. Since most of the decline is due to the high exit rate of small and medium sized farms, the central issue is whether current agricultural policy has helped or hindered the rural economy.

Given that agricultural resources are being transferred to larger farms, it is not surprising that operating profit margin increases with farm size. Hoppe and Korb (2006) find that large farms have positive average profit margins (14.5% or larger) that increase with sales volume. Medium sized farms only have a profit margin of 3.1% (which is insufficient to cover opportunity costs), and the profit margin for small farms is negative.[4] Small and medium sized farms only remain economically viable by engaging in off-farm employment. There is an inverse relationship between farm size by sales and total earned off-farm income.[5] Small farm financial viability is centered on non-farm earnings (total farm family off-farm income (earned and unearned) is approximately $70,000). This suggests that small farming operations are most likely hobby farms where operators have a high preference for rural amenities. Younger farm operators, however, may use small farming operations as means of becoming established and with a future goal of a self-sustaining commercial farm. As farms became larger, off-farm earnings decline which suggests increasing opportunity costs on both the operators' and their spouses' time.

Agricultural Policy

US agricultural policy is intended to stabilize family farms and rural population. US farm policies are producer driven and indirectly influence, hypothetically, the rural via a spending stimulus. A number of farm programs provide indirect support, such as export subsidies, crop insurance subsidies, and farm loan subsidies. Direct payment programs are the key feature of US farm policy. The USDA makes direct income payments to eligible producers of wheat, corn, barley, corn, sorghum, oats, upland cotton, rice and oil seeds. The amount of total farm payments is considerable, $149.5 billion over the last eight years, including $20.2 billion for FY 2005 and 2006.[6] The Canadian

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[3] The small farm class with annual sales of $10,000 to $49,000 and less than $10,000 are the largest in number of all farm classifications by sales size, and their number have remained relatively constant (while their failure rate is the highest, their entry rate is also the highest). These farms are also the least economically viable (they have a negative profit margin and household income must be supported by off-farm income), but may be important as an entry portal for younger farmers to grow into the larger commercial classifications. The data is from the ERS briefing (www.ers.usda.gov/briefing) and an ERS study Hoppe and Korb (2006).

[4] The estimated average profit margin is based on the 1997 Agricultural Resource Management (ARMS) data set (Hoppe and Korb, 2006).

[5] Estimates of farm family off-farm income is from ARMS data (Fernandez-Cornejo, 2007).

[6] USDA, ERS, Table 35-CCC Net Outlays by Commodity and Function, 2007.

government, however, has moved away from direct payments linked to commodity prices, and provided income assistance through Net Income Stabilization Account (NISA) where the government matches a portion of saved income. Other Canadian farm payment programs primarily target disaster income payments. Total Canadian agriculture payment programs totaled $4.9 billion for 2005.[7] The Canadian social programs (subsidized health care, etc.) are more generous than the US, but tax rates are higher, which lowers the rate of return to producers.

Advocates of farm subsidy programs argue that support payments are necessary for the sustainability of rural communities. Farm payments smooth fluctuations in farm income due to the variability of commodity prices. Purchases of farm inputs and equipment and consumption expenditures by farm families are stabilized, which in turn maintains the income flow of farm supply businesses, equipment dealers, retailers, and other businesses in the rural community. Without farm programs, rural community would suffer more severe contractions. Net farm income, however, amounts to 2% to 3% of total nonmetro personal income and less that 1% is from farm payments. Through the 1990s, income in farm dependent counties, however, grew at a much slower rate (1.6% annually) than the general nonmetro sector (2.6% annually).[8] Personal income in these counties is also more volatile and is highly correlated with commodity prices.[9]

In addition to stabilizing the rural economy, farm program proponents argue that farm income supports protect the family farm. Johnson (1991) argues that income supports stabilize farm income, raise land prices, and reduces the rate of farm operator losses; it also provides an incentive for farmers to employ more workers. If this is true, U.S. farm supports are desirable because they slow down farm operator loss, out-migration, and help stabilize farm dependent counties. Kilkenny (1993), using a computable general equilibrium model (CGE), simulates that a reduction in farm subsidies would cause both rural nonfarm employment and income to fall.[10] The surplus, however, can also be used to acquire more land and invest in more capital which would induce a greater out-migration. Even with the large volume farm payments, the US continues to lose farm numbers as farming operations consolidate and become larger. The increase in farm size is more pronounced in farm dependent counties (Drabenstott, 2005).

Critics of US agriculture policy have questioned the exorbitant cost and whether agricultural subsidies even stimulate rural economic growth. Drabenstott (2005) argues that farm income support programs have not been a strong stimulus to economic activity in the counties that are most dependent on them. Bureau of Economic Analysis (BEA) REIS data reveal that most counties heavily dependant on farm support payment had employment growth below the national average of 19% and about a third of those counties had negative growth.[11] The only farm payment dependent counties that had above

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[7] Some provinces provide direct payment linked to depressed commodity prices (Statistics Canada, May 2006).

[8] Counties are defined as agricultural-dependent if at least 20 percent of the total labor and proprietor income is derived from farming.

[9] Personal income in farm dependent counties fell 0.6% in farm dependent counties between 1994 and 1995 while farm income fell 22% due to low commodity prices. A similar pattern occurs in 1996-1997, when commodity prices again fall.

[10] Killkenny (1993) also forecasts that rural factor input costs would decline and stimulate rural manufacturing. The net effect, however, in the short-run forecast model is that rural economics activity negatively impacted. She also shows that the net welfare effect is positive (the increase in urban welfare from discontinuing the farm subsidies less the decline in rural welfare from the loss).

[11] Counties that receive farm payments that are 10% or greater of total county personal income are considered subsidy dependent.

average employment growth were either near metro areas or emerging regional retail centers. Population growth was even direr. Most farm payment dependent counties had negative population growth, and about a third had positive but below average growth. Goetz and Debertin (1996) find that direct farm payments increase rural out-migration in the US, but that greater off-farm employment opportunities mitigate it. The small number of counties that exceed average US population growth of 10% (2002-1992) are near metro areas, developing retail centers, or had attractive rural amenities (McGranahan and Beale, 2002).

The trend in wealth nonfarm ownership of farms suggests a pure rent seeking motive, which has been criticized by the US General Accounting Office (GAO) for allowing nonfarm owners to collect the bulk of farm payments.[12] US direct farm payments are becoming more concentrated in large farms. In 2002, 51% of farm payment went to farms with annual sales more than $250,000. Furthermore, the subsidies are capitalized in land values, which make it more difficult for younger farms to take over farms. Half of the subsidy payments went to farm households with incomes more than $60,500 (median US income is $42,400), and the top 1% of farm household income received 22% of farm payments. Median farm household wealth (2002) was $329,000 while median nonfarm household wealth was $87,000 (91% of farm household have above median wealth). About 45% of farmland is operated by a tenant, so increasingly individual or partnership landlords do not live on the farm, and 66% of the owners are employed or are retired from nonfarm sector firms.[13] New farm payment data from ERS shows that between 2000-09 total government payments to farmers was $165 billion. Farm commodity payments represent 60% of government payments to farmers and direct commodity payments are about 50% of the commodity payments, and 40% are trigger payments based on commodity prices. Conservation payments are 14% and disaster relief and other programs are 26% of government payments to farmers. Of total payments, 62% goes to commercial farms (value of sales greater than $250,000), 19% goes to intermediate (primarily family) farms and 19% goes to rural farm residences (which primarily receive conservation payments). Commercial farm share of government programs has gone from 48% to 62% over the last 10 years. The percent of government programs of total value of production has gone from 28% to 12% over the last 10 years for intermediate size farms and from 65% to 82% for commercial farms. Over 2000-09, rural residence farms that received government payments on average received $4,700 per farm, intermediate farms received $10,800 per farm, and commercial farms received $43,700 per farm. Canadian farm subsidy programs are subject to similar criticism.[14] Farm family income, regardless of farm size, was greater than average Saskatchewan per-capita income in 1995 (Stabler and Olfert, 2001). The long-run trends suggest that US agricultural policy has failed to ameliorate the decline in the family farm or provide a stimulus to the rural economy.

There is mounting evidence that farm payments create production distortions that exacerbate the survivability of small and medium-sized family farms, accelerating the consolidation of farming into large commercial operations. Key and Roberts (2007) find that greater commodity program payments per acre are associated with increasing cropland concentration over the last 15 years. Using concentration defined as cropland-weighted median farm size (at the ZIP Code level), Keys and

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[12] Brian Faler, Washington Post, Organic Consumers Association, June 16 2004.
[13] Roberts and Keys (2003) and Smith (2001), in particular, have a good discussion of the adverse income redistribution effects of the commodity payment programs.
[14] US Department of Agriculture, Economic Research Service, *"New Farm Payment Data,"* http://www.ers.usda.gov/briefing/farmincome/govtpaybyfarmtype.htm

Roberts estimate percentage change in quintile concentration measured by payments per acre. They find that growth in concentration is greatest in the highest quintiles of payments-per-acre. Concentration grew by 46.3% in the 4th and 5th quintiles between 1987 and 2002 (controlling for crop land quality and density).

Key and Roberts also investigate the relationship between commodity payments and farm survival. They estimate farm lifespan by sales quartile and quartiles of commodity payments as percent of sales. Key and Roberts show that the duration of farm survival increases between 2.5% to 2.1% (depending on the sale quartile) as commodity payment increase from 0% to 12% of sales (the 1st quartile) to 36% (and greater) percent of sales (the 4th quartile). Given that commodity payment programs seem to influence farm size and the probability of farm operation survivability, it is arguable that commodity payment programs could also be driving the concentration in farm size that has been observed over the last 25 years. While Key and Roberts present strong evidence that commodity payment programs are driving farm consolidation, they note that there may be unobserved market forces that could be changing farm structure.

Chau and de Groter (2005) develop a theoretic framework to explain farm exit in the presence of a policy regime of direct commodity payments. They show that direct payments will cross-subsidizes production at world market prices that are below average variable costs if the farm producer has increasing returns to scale (i.e., average variable costs decline as production expands). Chau and de Groter provide theoretical credence to the argument that commodity program payments are a causal factor in the trend of farm consolidation. Their findings suggest that commodity payment programs raise profits via cross-subsidization and that it is possible for the amount of cross-subsidization to increase with scale as the farm operation's output increases (the level of cross-subsidization increases relative to cost of the subsidized expansion of output). In the presence of commodity payment programs, larger farms will receive a greater level of cross-subsidization and hence, higher augmented farm earnings relative to small and medium sized farms. This would be consistent with Hoppe and Korb (2006) results of larger farms earning higher profit rates. The greater earnings, however, are due to a market distortion from the commodity payment programs and not from pure market incentives.

II. Rational and Significance

We propose to investigate farm exit and entry phenomena at the county level to disentangle the factors that cause net-farm exit and entry dynamics. Goetz and Debertin (2001) utilize this analytical approach to study farm exit behavior. They hypothesize that while off-farm income stabilizes farm family income, off-farm employment may promote the transition of farm operators out of farming and into full-time off-farm work. Goetz and Debertin estimate net-exit function as well as a probability model to explain the exit decision. They integrate USDA Census of Agricultural data with Bureau of Economic Analysis (BEA) REIS to investigate farm exits in the context of local economic activity. The farm exit decision is made in the context of a transaction cost associated with the exit. If a farm operator is already employed off-farm, the transaction costs associated with nonfarm employment have already been met (search costs, equipment and wardrobe cost, etc.). The local economic environment will influence expected off-farm earning growth as well as the risk of job loss. Goetz and Debertin find that off-farm employment reduces the likelihood that counties lose farms. Once a county suffers a net-loss of farms, however, off-farm employment accelerates the rate of farm loss. Government subsidies have a similar effect. Subsidy payments accelerate the likelihood of farm exit once the county becomes net loser of farms.[15] Goetz and Debertin, however, do not investigate how off-farm employment and commodity payment programs influence farm exits by size. We feel this is an important gap in the literature.

We argue that the exit (and entry) decision is more entangled. Krugman (1991) argues that regional economies are linked via trade to larger urban-centered economies (and national and international economic events). Farms are unique in that they supply both output and inputs (via off-farm labor). Partridge *et al*. (2007a, 2007b) argues that rural areas may benefit when the urban-centered growth "spreads" outside the urban center, especially to areas with in daily commuting distance. Urban-center growth may also create a "backwash" in rural locations as households relocate to the urban center. Spread and backwash effects operate in addition to long-run distance-from-urban-center trend effects and must be disentangled to determine the net impact of urban centers on outlying rural areas.

Rural-urban population and employment interdependencies exist through commuting, population migration, and firms and households fleeing urban congestion and high costs. Rural areas that are well-linked to urban centers may then experience population and job growth resulting from urban agglomeration economies—the "spread" effect. Population and employment growth in rural areas can also result from urban congestion as households seek rural amenities, and firms are attracted to lower land and labor costs in nearby rural areas while retaining access to the urban center (i.e., decentralization). Generally, spread effects occur when rural population/employment growth originates from urban growth, regardless of the source (i.e., agglomeration economies, decentralization, etc.).

How farms fair in counties with urban spread effects presents its own set of questions. Decentralization puts upward pressure on land values and increases the opportunity costs of remaining in farming. This would be especially true for small and medium-sized farmers. Urban agglomeration economies would tend to raise off-farm wage rates. Whether this stabilizes small and medium sized farm operations or lowers the transaction costs of exiting farming remains an empirical issue.

Alternatively, rural population and employment opportunities may decline as a result of increased economic activity in urban centers—the "backwash" effect. Growing regional urban centers may cause rural-to-urban migration to take advantage of better employment opportunities and access to urban services and amenities. This, arguably, could negatively impact farming by reducing the transaction cost of exiting farming. Since small and medium-sized farm operators are more closely tied to off-farm employment, the "backwash" effect could conceivably increase the exit rate of these farm operators.

Adamson et al. (2004 and 2007) find that much of the rural to urban migration evolves highly educated, highly skilled workers who appear to demand urban agglomeration benefits and amenities. Agglomeration benefits may attract firms from rural to urban locations. All else constant, the spread would hypothetically affect rural areas closest to the urban center, while backwash may prevail beyond the maximum daily commuting distance which would limit urban employment opportunities and urban amenities such as shopping and entertainment. How the backwash effect would impact farm

[15] Other factors reported by Goetz and Debertin that influence farm exit, include operators age (exit rates increase until operators are in their late 40s); proximity to metro areas and population density increases exits; agriculture intensive counties, higher land values, higher irrigation rates, and live-stock operations all decreases exits.

operations is uncertain, but it is likely that younger operators with high levels of human capital will be the most likely to exit. The rural-to-urban migration would limit any urban market pressure on land costs, but small and medium sized operators may be enticed to exit farming to take advantage of the income growth in the urban center, given their lower return from farming.[16]

The size and geographic extent of “spread” and “backwash” will depend on the characteristics of the rural and urban areas, the nature of the economic linkages and amenities, governance structures, and the ease of transportation and communication access. Distance to urban centers and the size of the rural community will matter in determining the net spread/backwash effects. “Spread” and “backwash” effects must be understood in the context of urban proximity. In order for urban growth to result in net in-migration to rural areas, the spread effects must be large enough to overcome the urban distance effect. The closer the rural area is to the urban center, the smaller the spread effect needs to be to overcome the urban distance effect. For more remote urban areas, the geographic distance over which there are any “spread” effects from an urban center may be insufficient to generate positive rural growth and may experience only “backwash” effects.

The initial study will focus on South Dakota. Eventually, the will be extended to the North Central Region, Iowa, Minnesota, Nebraska and North Dakota, These regions have similar farm technologies and productivity. Since they are part of the North Central Region, there is regional economic symmetry. They are primarily rural and are experiencing slow or declining population growth in their rural counties and vast distances between the larger, growing metropolitan centers in the region.

Rural out-migration pattern is particularly evident in the Great Plains, where communities are heavily dependent on extractive types of economic activity. The majority of rural counties in this region experienced depopulation between 1920 and 2000. Small urban areas have maintained their population base but on an average experienced net out-migration. Large urban and metro counties in this region are generally the recipients of in-migrates and have had the strongest population growth. Indeed, Rathge and Highman (1998) argue that agricultural dependency is a strong predictor of out-migration. In a study of the US Great Plains, they found that 183 of the region's 478 counties, all which are rural or small urban, experienced continued population decline between 1950 and 1996. The diversity of public policy milieus in the Canadian and US plains makes this an interesting region to study farm structure.

III. Methodology

The primary goals of this project is to examine changes in US farm exit and entry patterns and whether the US farm policy has differing impacts on farm structure and rural economic dynamics. Using the quasi-natural experiment created by the differing policy environments in both countries, the analysis will investigate differences in their farm structure dynamics in relation to the unique regional level of economic activity.

The theoretical underpinning of farm entry and exit is utility maximizing behavior by farm operators. Farm households are assumed to have a utility function based on some combination of

[16] Hoppe and Korb (2006) find that the rate of return on farm operations increase with farm size.

goods and services consumed, nonpecuniary benefits from lifestyle (rural amenities, self-employment, etc.), leisure hours, and exogenous factors such as risk aversion. More formally:

(1) $$U = U(C_h, L_{h,}, A, H; \phi)$$

Where C_h represents the goods and services consumed by the household, L_h is the leisure (or nonproduction) time consumed by the household, A_h represents the household amenities associated with the nonpecuniary benefits from farm/rural lifestyle and self-employment, H is household human capital, and ϕ reflects exogenous other household characteristics (e.g., risk aversion etc.) and local area characteristics (e.g., economic growth, etc.).

Utility is maximized subject to income and time constraints given a production technology employed by the operator (the applied production technology determines output from a given level of resource inputs, including the operator's time). The constraints are represented by:

(2) $$pQ(K, h_f; \delta) + g - w_k K - w_o h_o - \tau(T) + N$$

Where p is the price of agricultural production, $Q(\cdot)$ is the agricultural production function, K represents capital and land inputs, h_f are the hours of farm labor input, δ represents the farm technology and operator entrepreneurial skills, g are the government commodity program payments, w_k is cost of capital and land inputs, w_o is the off-farm market wage rate, h_o are the hours of off-farm employment, $\tau(\cdot)$ is the transaction cost function associated with working off-farm, and N represents nonearned income from household financial assets. Time allocation in hours for a given work day is defined as: $h = h_l + h_f + h_o$, where the hours subscripts reflect leisure, farm work, and off-farm work hours, respectively. The transaction cost function is defined as: $\tau(T) = t_f + t_v + h_o$, where t_f are fixed transaction costs (e.g., search and other costs associated with entering the off-farm work force), and t_v are variable costs (e.g., commuting time and costs).

In a given time period, farm operators evaluate expected future utility (equation 1 maximized subject to the constraints in equation 2) from farming versus exiting and work in a full-time nonfarm occupation. This decision is expressed in the following expected utility functions:

(3a) $$F_t = \int U_t (C_h, L_{h,}, A, H; \phi) e^{-rt} \, dt$$

(3b) $$E_t = \int U_t (C_h, L_{h,}, H; \phi) e^{-rt} \, dt$$

Where F_t is expected utility from farming in period t, E_t is expected utility from exclusive off-farm employment in period t (note that A, amenities from farming, is zero in equation 3b), and r is the discount rate on future expected utility. If the expected utility from farming at a given point in time is less than the expected utility from exclusive off-farm employment ($F_t < E_t$), the farm operator exits the industry (otherwise ($F_t > E_t$), the operated stays in farming. If the farm operator is a new entrant into farming, then the expected future utility from farming exceeds the expected utility from nonfarm employment ($F_t > E_t$) (otherwise ($F_t < E_t$), the household remains in the nonfarm sector).

Expected utility is lowered by the presence of transaction cost (represented by $\tau(\cdot)$). The presence of fixed entry costs into an off-farm occupation discourages off-farm employment, but the reduction in income from off-farm employment lowers expected utility from farming. Once a farm operator enters the off-farm labor market, only variable transaction costs will influence the off-farm employment decision. Furthermore, once a farm operator is employed in an off-farm job, it also lowers the transaction cost of exiting farming because the fixed entry cost has been met. Similarly, the transaction cost of entry into farming will contain both fixed costs (acquiring the tools and equipment to operate a farm) and the variable costs of commuting between the operator's off-farm job and the operator's rural residence. Distance to the nearest urban center for off-farm employment will increase with miles in the distance function. "Spread" effects in the rural will likely increase expected utility from farming and "backwash" effects will likely diminish expected utility from farming.

If cross-subsidization exists, g will be greater for large farms than for medium or small farms, and expected utility from large farm will be greater than expected utility from medium or small farms. Relative to transaction costs, g will reduce the probability of exit for large farms and increase the probability of exit for small and medium-sized farms, increasing concentration. The interaction of these effects becomes complex and identifying them becomes an empirical question to be resolved with the econometric analysis.

The expected functions utility in equations (3a) and (3b) theoretically explain the exit and entry decision by farm operators. The expected utility functions can be written as reduced-form equations containing the variables in the utility function as well as the conditional variable that determine income from farming and off-farm employment. The income constraint can be expressed as an earnings function of farm household income. We can then investigate exit/entry decision for farm operations in the context of the regional economy. We first estimate an interregional hedonic earnings function that determines individual farm family income. This model is then used to disaggregate the equilibrium and the disequilibrium components of earnings.

Some farm operators will allocate a majority of work hours to farm operations, others will balance work effort between farming and off-farm work. Time input will vary based on the type of operation (type of crop, livestock co-production, farm size, full-time off-farm employment, etc.). Special attention will be paid to the possibility of incomplete compensation for hours spent on farm operations, commuting time to regional trade center for off-farm work and consumption activities, and the locational amenity/disamenity mix. As has been shown in Clark *et al.* (2003, 2006), incomplete compensation is a critical factor in the migration decision which is similar to the decision to entry or exiting from farming. The individual decision is based on an interregional hedonic earnings model that incorporates non-traded site-specific amenities, geographic influences as well as county and MSA level labor market conditions. The analysis incorporates separate metropolitan area and nonmetropolitan area samples. Specifically, we use the Census of Agriculture data to estimate the following model:

$$E_i = E_i\ (HC_i,\ FC_{ij},\ A_j)$$

Where $E_{i,j}$ represents the farm household earnings of operator i in location j; is a vector of human capital characteristics of operator i, FC_{ij} is a vector of farm characteristics of operator i at location j (farm characteristics will change with location because of rainfall, soil quality, etc.), and A_j is a vector of locational attributes (local agricultural characteristics, local economic conditions, natural and social amenities, taxes, government services, etc.).

The Census of Agriculture releases county level data. Confidential census data is available at the ZIP code level.[17] A narrower the geographic scope allows a more precise measurement of locational fixed characteristics. A fixed effects estimator is used to estimate the hedonic earnings model which will be used to disentangle the compensating differentials for the site characteristics, the type of farming operation and human capital at different locations. Using the methodology outlined in Clark *et al.* (2003), we will identify locations which overcompensate or undercompensate for the local fixed characteristics mix.

Then, in the thrid stage, we estimate exit/entry models for both farm operator samples. Two types of logit models will be estimated. First, binary logit models of the decision to enter or the decision to exit a farming operation at a specific location will be formulated. These models examine the impact of farm operation characteristics, personal characteristics and location attributes on the probability of the exit/entry decision.

A disadvantage of binary logit is that the location features of the alternatives not selected cannot be incorporated into the model. This limitation can be addressed by using a conditional logit or mixed logit framework. This family of models incorporates *N* alternative desions and therefore more flexible in this respect than the separate binary logit models. Conditional logit enables the researcher to specify the right hand side variables to include variables for *N* alternative decision and therefore is consistent with the utility maximization framework that underlies the exit/entry model. Conditional logit estimators have been employed in industrial location and foreign direct investment modeling.[18] A disadvantage is that individual characteristics (farm operation, personal etc.), which, by definition, do not vary across the choices, can only be included in the model in a very limited fashion. As such, much of the important influence of static characteristics on exit/entry behavior is subject to restrictions in the model. It is for this reason that we will selectively employ both types of models. The binary logit model for the probability of migration into, or out of a farming operation at location *j* is of the general form:

$$\text{Prob}[\text{migrate}_{i,j}] = f(PC_i, FC_{ij}, \text{Ehat}_j, \text{Diseq}_{i,j}\ \ A_j)$$

Where PC_i is a vector of personal characteristics for individual *i*; Ehat_j is the predicted farm household earnings based on farm and human capital characteristics at *j*; Diseqi,j is the disequilibrium component of farm income (i.e., over- or under-compensation at location *j*), and A_j is a vector of amenities and other site characteristics at location *j*. We will examine binary logit models examining the decision to enter into farming (i.e., where j is the destination) and also exit out of farming (i.e., where j is the origin).

The general form of the conditional logit model is:

[17] Confidential census files can be accessed at the regional National Agricultural Statistics Service (NASS) offices.

[18] Guimaraes, Figueiredo, and Woodward (2004) discuss the use of conditional logit model (CLM) estimation of industrial location. The critical issue is violation of the Independent Irrelevant Alternatives (IIA) assumption. They argue that Poisson regression likelihood functions can more effectively control for the IIA assumption. Cheng (2006 and 2008) addresses the IIA assumption when using CLMs to estimate location choices of Japanese foreign direct investment (FDI) in China. Cheng uses a Hausman-McFadden test to determine whether the IIA assumption is violated and finds CLMs provide robust estimates of the FDI location decision.

$$\text{Prob}\,(Y_i = {}_j) = \frac{e^{\beta' Zij}}{\sum_{j=1}^{J} e^{\beta' Zij}}$$

where j = 1, 2, …., J for a total of J alternatives.

The vector Z_{ij} reflects a vector of site characteristics (local agricultural and economic) including amenities (*A*), disequilibrium measures (Diseq), and systematic incomplete compensation for the site characteristics measuring the variation in site characteristics potential exit/entrant decision makers experience between potential destinations and their origin location. Farm operation and operator personal characteristics can enter the model by interacting them with one of the alternatives. One partial remedy is to estimate the conditional logit model for subgroups of the population. For example, estimating the model for farm households separated into categories reflecting certain variables of interest (e.g., small vs. large exits; more experienced vs. less experienced entrant, etc.) will serve to distinguish different entry/exit choices across such groups. We will explore a range of different groupings. Although the binary logit models cannot incorporate the information reflected by alternatives not chosen, this framework nevertheless offers a useful method for examining the determinants of the decision to enter in and exit out of farming. Its key advantage is that permits the inclusion of important farm and personal characteristics known to influence such decisions, such as those mentioned above, in a more precise and direct manner than that offered by the conditional logit model.

Following Partridge *et al*. (2007a, 2007b), we will also examine the role of "spread" and "backwash" effects relative to a "distance penalty" within its local urban-rural hierarchy. These authors have established that a location's population growth is influenced by its physical distance in miles from *several* cities, each being the closest city whose population lies within a given range. These effects represent the differing hierarchies of economic activity that are untaken at higher "order" regional trade centers which simultaneously influence the decision to enter or exit farming.

Description of Data and Data Sources**:**

We propose to use a longitudinal construction of the US Census of Agriculture. The US Census of Agriculture is published every five years. We propose to use a longitudinal construction of the 1978, 1982, 1987, 1992, 1997, 2002 and 2007 US Census of Agriculture. The data sets allow farm and operator data to be measured at the county and postal code level (restricted files).[19] This allows a more precise measure of the site-specific effects the effect farm operation as well as allowing a more precise measurement of the GIS data influences. Knowledge of the respondent's county of residence or Metropolitan Statistical Area (MSA) allows the construction of disaggregated measures of amenities and economic conditions at the local economic level, and the merging of this information with the individual's demographic and human capital measures. The initial objective will be to configure the data. This will involve merging the county and MSA level labor market, fiscal, farm program, and regional amenity data with the individual human capital data. The US data sources of regional data are the US Bureau of Labor Statistics (BLS) REIS data set; data on a wide range of local

[19] ZIP code delineated Census of Agricultural data is the approach taken by Keys and Roberts (2007).

outdoor recreational amenities and climate that is compiled in the 1997 NORSIS database (National Outdoor Recreational Supply Inventory System created by the USDA); crime from the 2000 FBI Uniform Crime Reports. Fiscal measures at the county level (e.g., per capita measures of county level spending on education, police, welfare, as well as revenues from local property and other taxes) will be derived from US Census of Governments data that is reported in the 2000 County and City Databook published by the US Department of Commerce. We will also consult the County and City Extra Data Book published by Bernan Press (various years) as needed. Finally, the *Census of Governments*, published by US Department of Commerce will be consulted for statewide tax data (e.g., income tax collections, inheritance and estate taxes).

The US Census of Agriculture is based on a survey conducted every five years. The Census of Agriculture attempts to survey all agricultural operations, regardless of size. From 1954 to 1974, the census was conducted by the Bureau of the Census for years ending in 4 and 9. The census year was adjusted in 1982 to a 5-year cycle where data collection occurs in years ending in 2 and 7. The Bureau of the Census conducted the Census of Agriculture from to 1992. In 1997, the National Agricultural Statistics Service (NASS) began conducting the Census of Agriculture. A farming operation is defined as any operation that produced or sold $1000 or more of agriculture products, or normally would have been sold during the census year. The Census of Agriculture surveys where merged to form a longitudinal data set by Robert Hoppe and Penni Korb of the Economic Research Service (ERS).[20] The longitudinal fie follows farming operations rather than farm operators. An exiting farm does not necessarily end and a new begin when farm operators change. A new census file number (CFN) indicates the end of a recognized farming operation and a new CFN indicates an entrance of a new farming operation. Operators in the Census of Agriculture are considered primary operators of family farms (family farms would include proprietorships, partnerships or corporations) and nonfamily partnerships and corporations. An existing CFN would continue under the following circumstances: 1) the current primary operator continues to operate the farm, 2) the farm is sold to a relative, 3) the farm is sold to an operating partner, 4) the primary operator retires and a junior operator continues the farm operation, 5) the original farm is divided into two or more smaller operations and a portion continues with the original operator, 6) the primary operator no longer farms and rents out the farmland and the renter operates the farm as a unique separate unit, or 7) part of the original farm is sold for nonfarm use. A new CFN would be issued in the following circumstances: 1) entire farm is sold to another operation, 2) an original farm is divided into two or more farming operations and one of the farms has a new operator, 3) an original farm is divided into two or more farming operations and all of the farms have a new operators, and 4) the primary operator no longer farms but rents out the farmland and the renter operates the rented land as part of an existing farm (the new CFN will be the renting farm's CFN).

The South Dakota longitudinal sample has 85,319 observations. We deleted abnormal farming operations (Native American reservations, grazing cooperatives, agricultural experiment stations, etc.) and small farms with imputed values of sales. This resulted in 79,628 observations. We have attempted to identify changes in primary operators by changes in age that are either greater or less than the number of years between surveys, in a number of cases to be inconsistent. We are still trying to identify the logical conditions that indicate an exit of a primary farm operator. The data indicates that a spouse may fill out the mail-in survey since the age and sex are inconsistent in the next survey and consistent in the succeeding survey (assuming there is not a significant incidence of sex changes

[20] See Hoppe and Korb 2006 for a discussion of the longitudinal data set.

among South Dakota farm operators). In addition, there are cases where the age is constant throughout the survey indicating that the person filling out the mail-in survey just copied the previous census form. These inconsistencies have made it problematic in identifying operator exits. We are still working on the programming logic needed to define operator exits.

Empirical Results:

We used a longitudinal sample of farm operators that entered the Census of Agriculture in 1978 for South Dakota. A probit model is estimated to measure the likelihood an individual exit farming in 1978. The sample data set has 34,039 observations. The reduced form probit specification for farm operator *i* is:

$$\text{Prob}\ (E_{it}=1) = P(\boldsymbol{\Omega H_{it} + \Psi F_{it}} + \varepsilon_{it}) > 0.$$

$E_{it} = 1$ for farm operators exiting farming in 1978 and $E_{it} = 0$ for farm operators remain in farming. Additionally, **H** is a vector of individual characteristics and **F** is a vector of farm characteristics that may influence the exit decision; **H** includes potential experience (EXP = age in 1978 – 18) and the square (ESPSQ), farming is primary occupation (FARMOCC) where the base is other occupations, female gender (FEMALE) where the base is male gender, race (BLACK, INDIAN, and OTHRACE) where the base is whites, and Hispanic ethnicity (HISPANIC) where the base is non-Hispanics; **H** includes acres of farmland (ACRES) and the square (ACRESQ), value of sales of agricultural produce (VALSAL) and the square (VALSALSQ), land part-ownership or rental tenant (PARTOWN and TENANT) where the base is individual land owner, operation structure of partnership, incorporated family farm, and incorporated nonfamily farm (PARTNER, FAMCORP, NONFAMCORP) where the base is family farm sole-proprietorship, production specialization in non-cash grain crops (FRUITOTH—melons, fruits, nuts, vegetables and ornaments) or animals (CATTLE, HOGS, SHEEP, DAIRY, POULTRY, ANIMALOTH—horses and specialty animals) where cash grain crops (wheat, corn, soybean and other grains) is the base, and farm size by value of sales (SMALL—sales less than $1000 and recreational farms, and MEDIUM—farms with sales between $1000 and $10,000) were large farm with sales greater than $10,000 is the base.

The parameter results are embargoed, but have a priori signs. The likelihood of operator exit decreases with experience (EXP is negative and significant, and EXPSQ is positive and significant), acres farmed (ACRES is negative and significant, and ACRESQ is positive and significant), value of sales (VALSAL is negative and significant, and VALSALSQ is positive and significant), primary occupation of farming (FARMOCC is negative and significant relative to non-farm occupation), part ownership and tenant (PARTOWN and TENANT is negative and significant relative to single ownership), fruit and other crops (FRUITOTH is positive and significant relative to cash grain crops), animal production (CATTLE, HOGS, SHEEP, DAIRY, and ANIMALOTH are positive and significant relative to cash grain crops), and small farms (SMALL is positive and significant relative to large farms). The likelihood of operator exit increases with female and Hispanic operators (FEMALE is negative and significant relative to MALES as well is HISPANIC relative to non-Hispanics), farm partnership and corporate structure (PARTNER, FAMCORP, NONFAMCORP is negative and significant relative to family sole-proprietorship), and medium farm size (MEDIUM is negative and significant relative to large farms).

Conclusion:

The preliminary results are promising. The parameter estimates are consistent with a priori expectations. Future development would be to develop the programming logic that will help identify operator exit in the 1982, 1987, 1992, 1997, 2002, and 2007 census surveys.

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