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Horses vs. Tractors? Old Order Amish Population Growth and New York Farmland Markets

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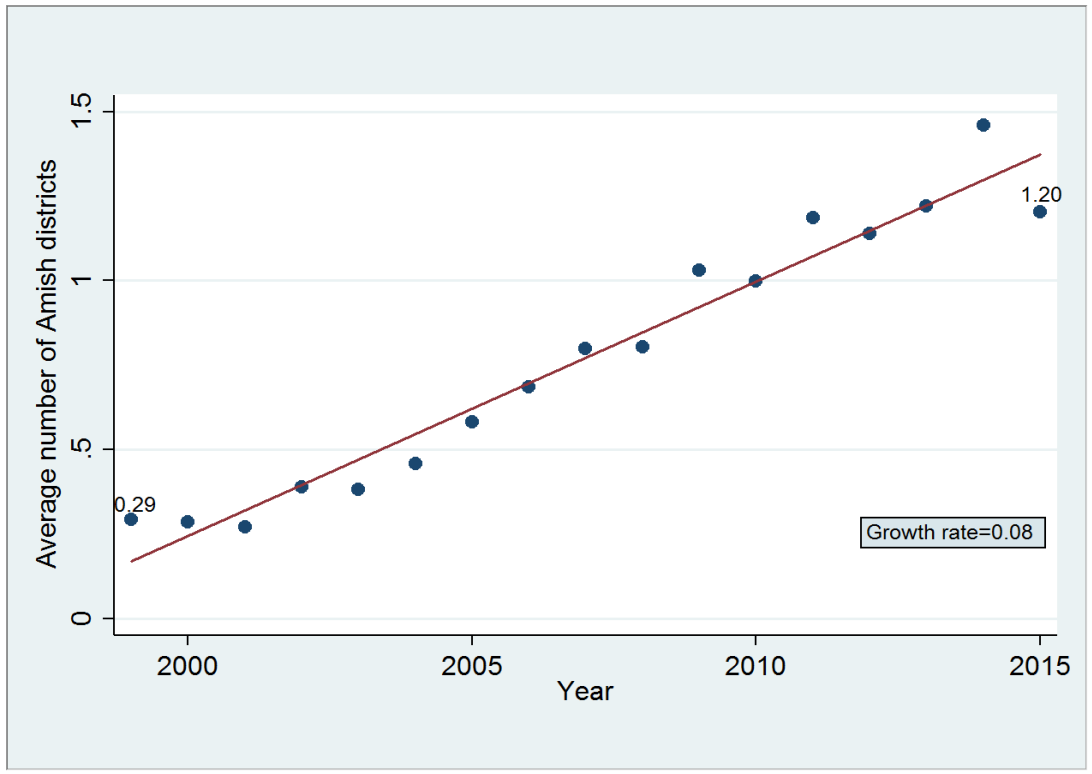
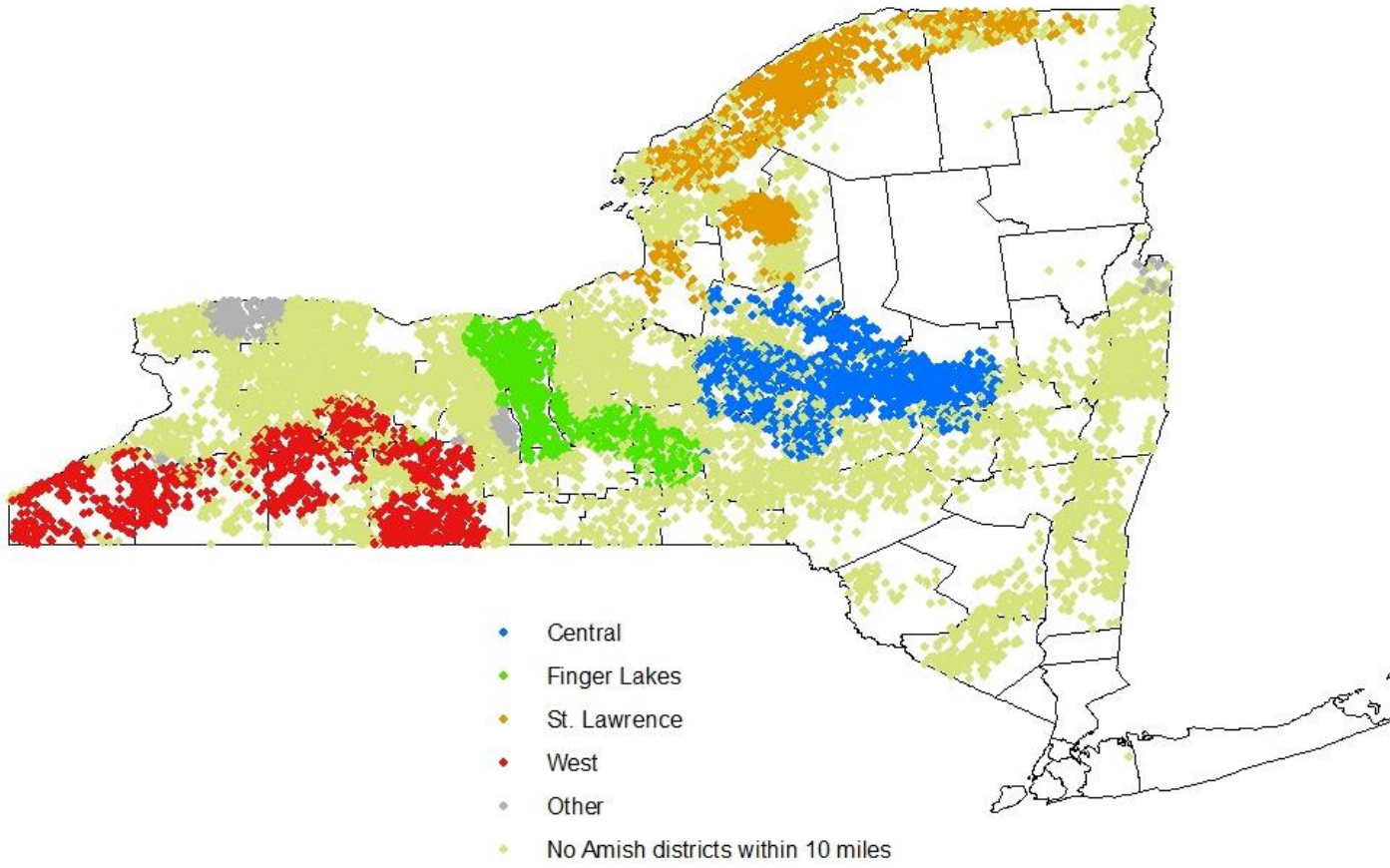
Introduction to the Old Order Amish

- Farming is an integral part of religious convictions that emphasize humility and family and community ties
  - Significant variation in practices and beliefs across groups
- Refuse or minimally use modern technology
  - Horses and mules for draught power, not tractors
  - No electricity or electronics, avoid telephone use
  - Do not drive cars, might hire drivers and vans

Sources: https://www.history101.com/amish-facts/ and https://www.nytimes.com/2010/06/09/science/earth/09amish.html

Amish population and presence in New York farmland markets

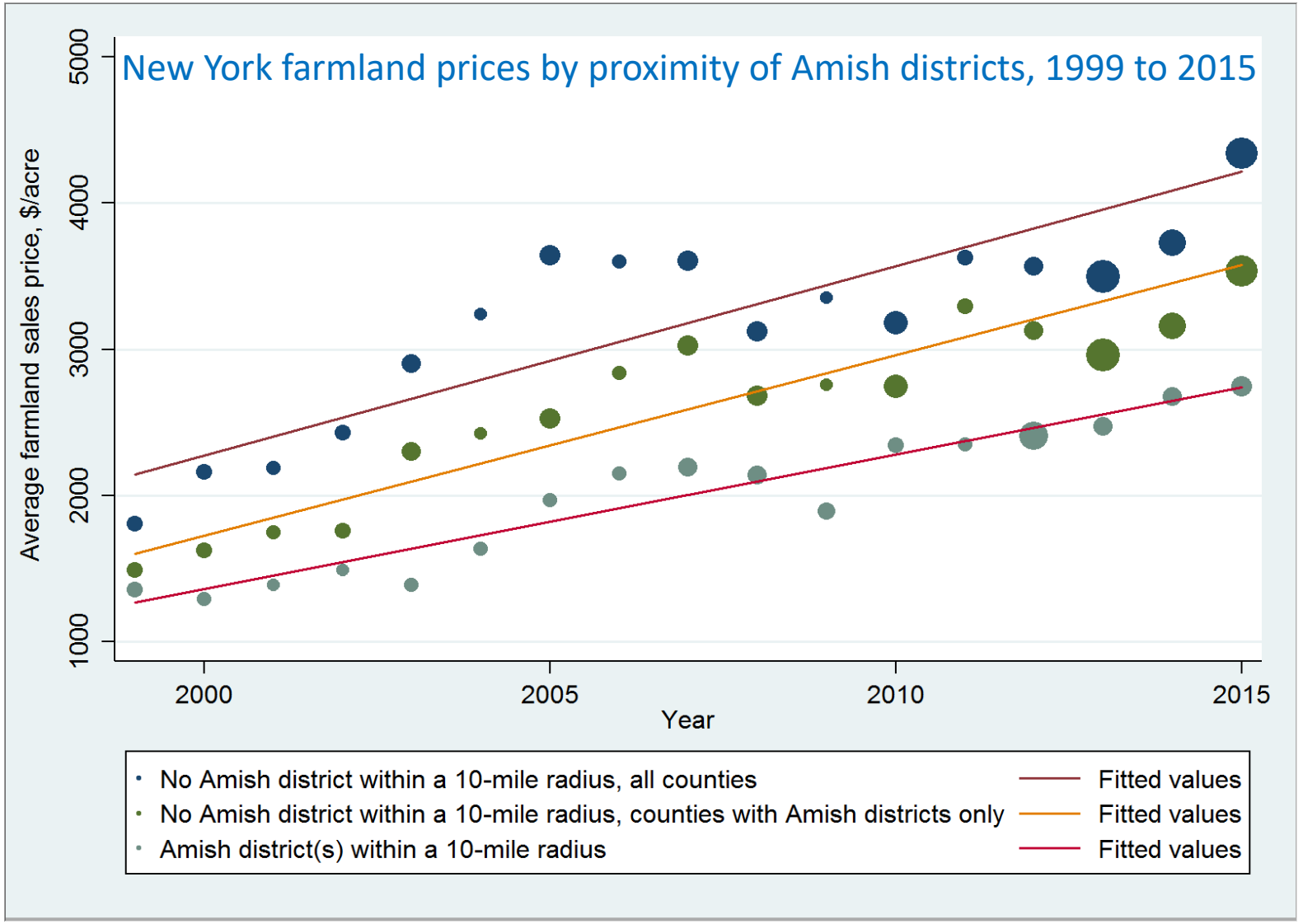




Substantial growth from 1999-2015
Average number of Amish districts located with 10 miles of an arms length NY farmland transaction

Each dot represents a parcel of farmland sold sometime between 1999-2015

Amish have settled in areas with lower farmland prices in NY



Motivation and research question

- **Substantial growth** of Plain/Amish settlements in some agricultural states, while operating a different, unconventional farming system
- **Farmland** and credit market dynamics might be affected by competition from Plain/Amish groups.
- **No/little** economics or finance research related to Plain/Amish groups, as far as we know. Most academic research focuses on:
  - 1) Rural sociology and occupation
  - 2) Religion
  - 3) Environmental regulation.

- This study aims to quantify the influence of Amish settlement on New York farmland markets.
  - We model the difference between Amish and conventional farmers, based on production technology and labor intensity and cost.
  - We use a parcel-level farmland sales dataset to evaluate the impact of Amish population growth on New York farmland prices.
  - We also contribute to the literature:
    - ✓ (1) the inverse farm productivity–size relationship,
    - ✓ (2) competitiveness of small farms.

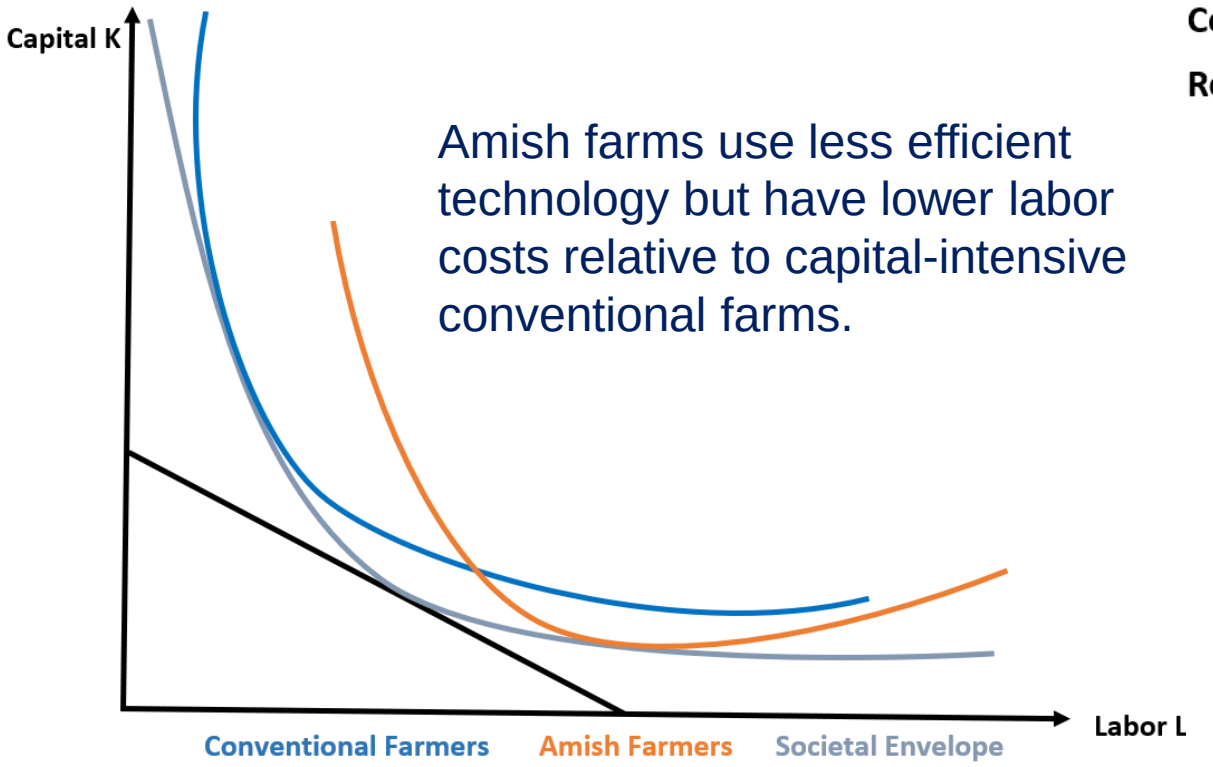
Basic observations: conventional vs. Amish farmers:

FCS 2018 Dairy Farms	Conventional	Plain Farm
Production per cow lbs./year	25,264	20,974
Pounds milk per hired worker	1,255,687	832,830
Labor, living, inc. tax $/cwt	3.66	2.50
Breakeven milk price $/cwt	17.70	16.20
Gross farm revenue $/cow	5,104	4,003
Gross farm expenses $/cow	5,021	3,657
Net farm income $/cow	83	346
Return on assets	1.51%	1.43%
Return on equity	2.26%	2.06%

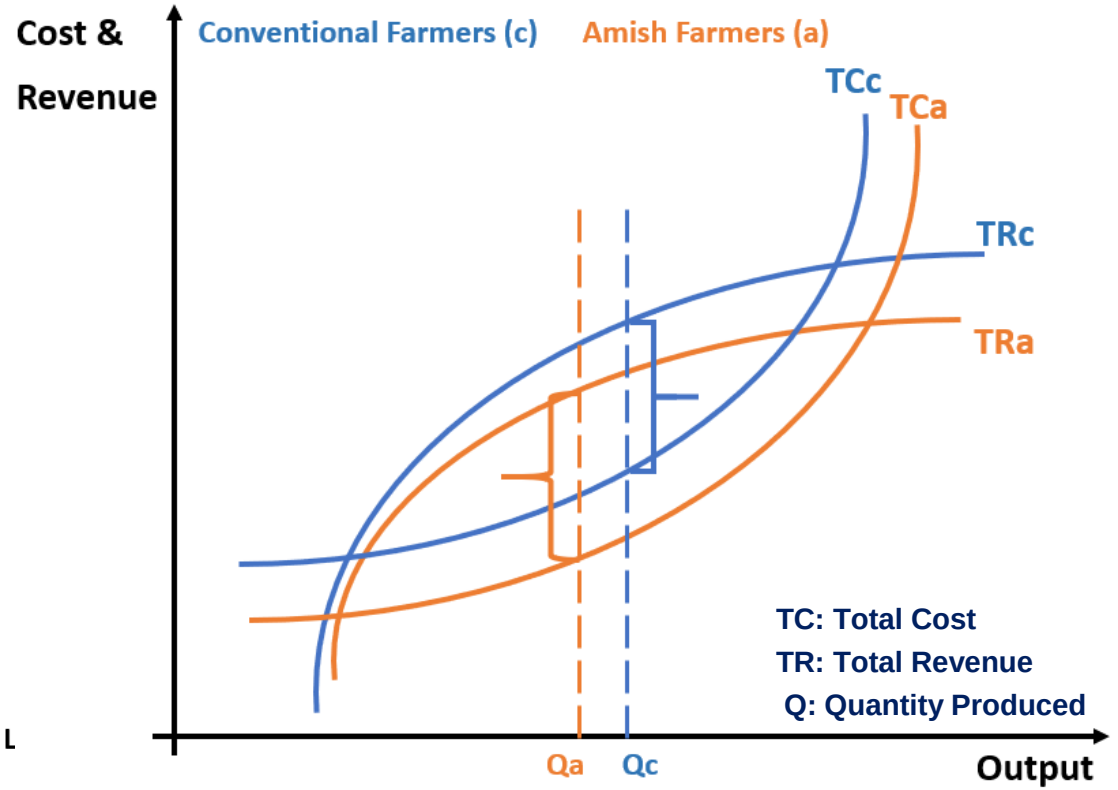
- Plain farmers have lower input costs and their family labor is implicitly “undervalued” relative to conventional producers, due to their religious and cultural traditions (Reid 2016).
- Plain farms on average produce less milk per cow (17% lower) but have plentiful family labor.
- Lower costs (including 30% lower labor cost/CWT) help plain farms achieve a similar return on assets and higher net farm income per cow than conventional farms.

Source: Farm Credit East dairy farm survey data from 305 conventional farms and 27 Plain (Old Order Amish and Mennonite) farms

Conceptual framework: conventional vs. Amish farmers



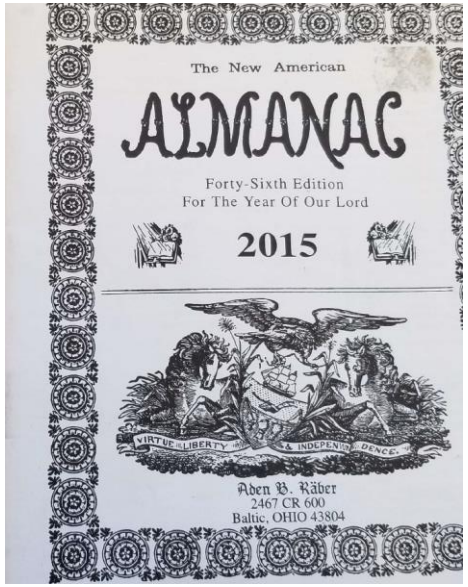
Amish farms use less efficient technology but have lower labor costs relative to capital-intensive conventional farms.

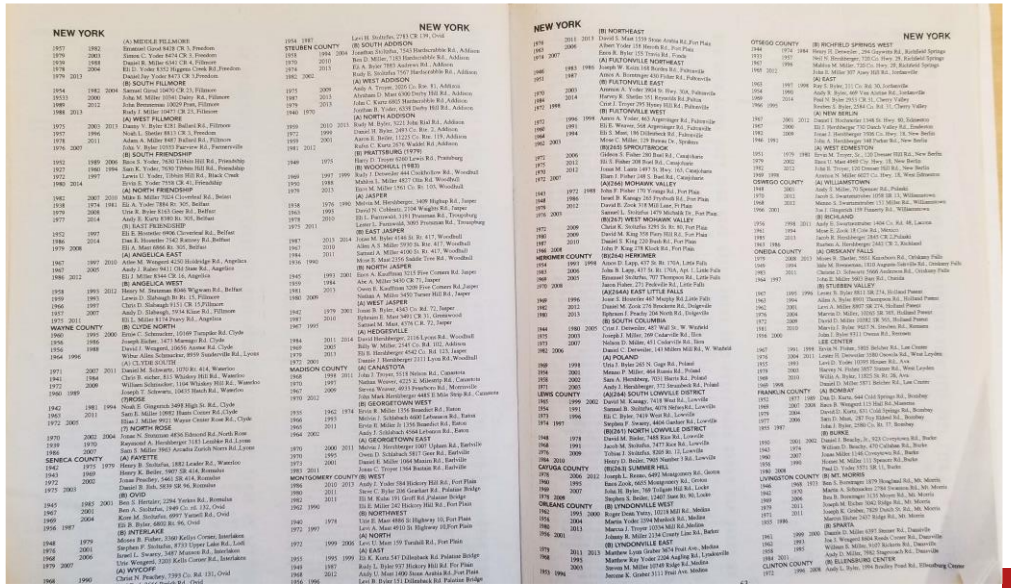


- Conventional farmers generally have higher total costs, outputs, and revenues than Amish farmers (right panel).
- Amish farmers who are not operating on the production technology frontier could be profitable and compete with farmers that do – Feasible to reach same level of profits, as represented by the orange (Amish) and blue (conventional) brackets (right panel).

Data sources

- New York State farmland transactions data over 1999 to 2015, obtained from New York's Office of Real Property Tax Services and property assessment offices in each county.
- Each transaction has attributes such as sales price, acreage, detailed location, and property usage type at the parcel level.
- We append the location matched Amish population trend - the number of Amish districts (church groups) within a 10-mile radius of each observation (transacted parcel), developed by Ifft and Gao (2019). The raw data of Amish was from directory of ministers (Raber's Almanac).





Data selection and characteristics

- Dropped the observations: price > 50,000 and < 100 dollars per acre; with no detailed spatial identification (latitude and longitude). In total of 21,137 raw --> 17,481 left after drop.
- Tested various sub periods to see temporal differences and possible structural breaks.
- Final preferred specification conducted 2007 – 2015 with 6,806 observations.
- Particularly for agriculture side, 2007 is when corn prices started going high; also when real estate markets starting going crazy with the financial crisis.

Key Variables	Obs	Mean	Std. Dev.	Min	Max
Deflated Price $ / Acre	17481	4673.013	8129.841	103.516	90419.06
Ln Def. Price / Acre	17481	7.783	1.057	4.64	11.412
Amish Trend	17481	0.698	1.715	0	16.824

Empirical model

- We employ the standard hedonic model approach for evaluating farmland prices.
- Start with estimating a standard OLS regression model:

$$P_{it} = \beta_0 + \beta_1 AT_{it} + \beta \boldsymbol{X_i} + \tau_t + \gamma_s + \varepsilon_{it}$$

  - P_{it} : the deflated log price of farmland i in year t per acre.
  - AT_{it} : Amish Trend, indicates number of Amish Churches within the 10-mile radius of land i in time t.
  - $\boldsymbol{X_i}$: a vector of farm and operator characteristics that contain control variables; including geographic and soil characteristics, and nonagricultural characteristics.
    - Control variables selection is based on the LASSO estimator developed by Ifft and Yu (2019).
  - τ_t and γ_s: standard year and region fixed effects.
  - ε_{it}: a white noise error term.
  - Acre weights and county-cluster standard errors are used following Bigelow, Ifft and Kuethe (forthcoming).

Potential endogeneity

- Correlated unobservables
  - The number of Amish districts may be correlated with unobservable factors that are related to farmland sales; as Amish are known to carefully consider farmland market characteristics when buying land (Johnson-Weiner, 2017).
- Simultaneity
  - The Amish farmers make decisions related to farmland purchases and settlement locations simultaneously. It's not clear if the land price changed due to enclaving, or if the Amish migrated to certain locations and enclave due to land markets.
- Network effects
  - Newly-arriving Amish may move into existing Amish communities and buy farmland from them.

Instrumental variable

- We constructed an enclaving instrumental variable (a shift-share IV) based on a well-established approach in the labor economics literature, e.g. Lewis (2003). The basis for these IVs is that immigrants tend to settle in areas near people from their home country (Bartel, 1989).
- Use the initial share of church districts in a county to the state in 1995 multiplied by change in the number of church districts from 1995 to 2005. C_j^{95} is the number of church districts of county j in 1995.

$$Z_{ij} = \frac{C_j^{95}}{\sum C_j^{95}} (C_j^{05} - C_j^{95})$$

- Underlying identification assumptions:
  - Inclusion: Amish tend to settle in areas already have Amish communities with similar practices.
  - Exclusion: Early growth in Amish communities and its population share are exogenous to current land markets movement, if the share's lag is chosen long enough (>10 years).

Empirical results: OLS

2007-2015	Standard_OLS_NON_IV			
VARIABLES	Standard	+CAFOs	Drop < 5 Acres	Drop < 10 Acres
Specs #	(1)	(2)	(3)	(4)
Amish trend	-0.0129	-0.0123	-0.0192**	-0.0174*
	(0.0126)	(0.0126)	(0.0088)	(0.00931)
Constant	9.143***	9.061***	9.510***	9.202***
	(0.472)	(0.479)	(0.46)	(0.435)
Observations	6,806	6,806	6,417	5,950
R-squared	0.309	0.309	0.282	0.311
Acre Weighted	YES	YES		
County Cluster	YES	YES	YES	YES

- 'Amish trend' does not have a statistically significant relationship with farmland prices.
- Dropping small acre sales slightly increases statistical significance, though endogeneity issue remains.

Empirical results: Enclave IV two-stage least squares (2SLS)

2007-2015	IV1_Enclave Shift Share		
VARIABLES	IV1	1st Stage	+CAFOs
Specs #	(1)	(2)	(3)
Amish trend	-0.0418		-0.0409
	(0.0431)		(0.0437)
IVZ_Enclave		0.962***	
		(0.102)	
Constant	9.124***	2.756*	9.051***
	(0.48)	(1.425)	(0.486)
Observations	6,806	6,806	6,806
R-squared	0.305	0.431	0.306
Acre Weighted	YES	YES	YES
County Cluster	YES	YES	YES

- First stage is “strong”, with F stat well above 10.
- Amish trend does not have a statistically significant relationship with land prices.

Empirical results: Enclave IV (dropping small acres)

2007-2015	IV1_No Acre Wgts but Excluding Small Acres (< 5 and < 10)					
	Excluding Acres < 5			Excluding Acres < 10		
VARIABLES	IV1	1st Stage	+CAFOs	IV1	1st Stage	+CAFOs
Specs #	(1)	(2)	(3)	(4)	(5)	(6)
Amish trend	-0.0599		-0.0633	-0.0545		-0.0564
	(0.0387)		(0.0393)	(0.0375)		(0.0382)
IV1_Enclave		0.914***			0.922***	
		(0.125)			(0.123)	
Constant	9.421***	1.305	9.401***	9.124***	1.439	9.125***
	(0.424)	(1.12)	(0.428)	(0.41)	(1.118)	(0.414)
Observations	6,417	6,417	6,417	5,950	5,950	5,950
R-squared	0.276	0.432	0.276	0.305	0.431	0.305
County Cluster	YES	YES	YES	YES	YES	YES

- Dropping small acre sales and removing acre weights slightly lowers the coefficient of Amish trend, but statistical significance is unchanged

Robustness check: alternative IV

2007-2015	IV2_value_yield		
VARIABLES	IV2	1st Stage	+CAFOs
Specs #	(1)	(2)	(3)
Amish trend	-0.567*		-0.538*
	(0.334)		(0.283)
IV2_value_yield		-0.0779	
		(0.0495)	
Constant	8.763***	0.948	8.880***
	(1.418)	(2.404)	(1.283)
Observations	6,806	6,806	6,806
R-squared		0.316	
Acre Weighted	YES	YES	YES
County Cluster	YES	YES	YES

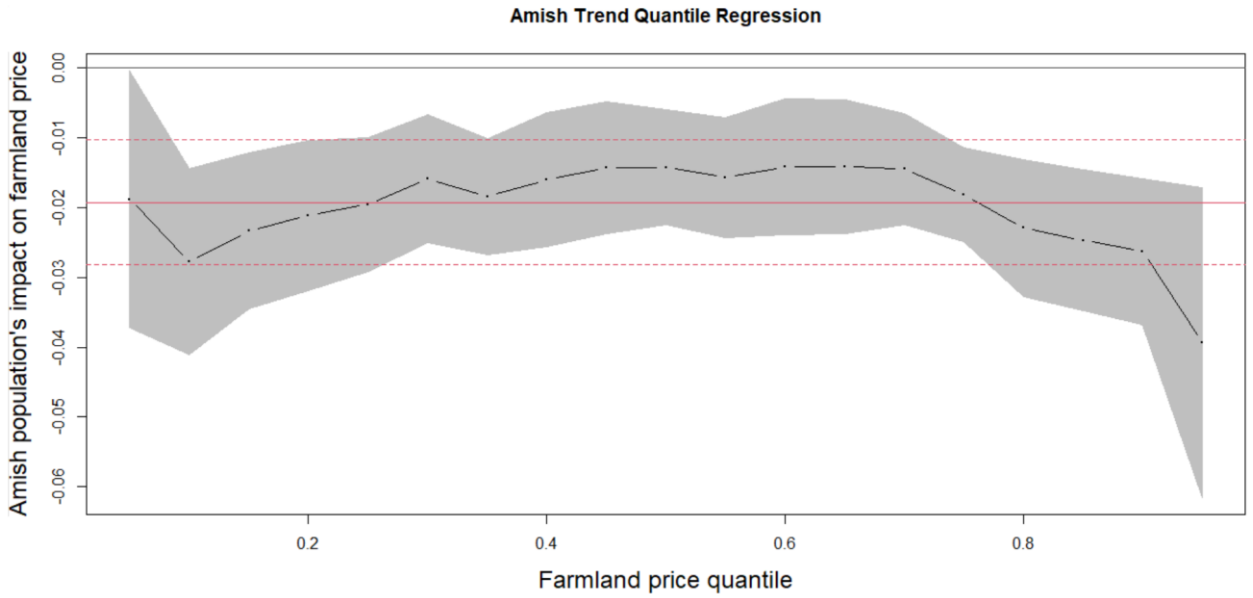
- IV2 is the ratio of county farm real estate price per acre to corn yield in 1997, to proxy for farmland affordability, which may be a key driver of Amish settlement decisions (Ifft and Gao, 2019).
- First stage is not significant, weak IV problem
- Tested employing both IVs but IV2 remain statistically insignificant.

Work in progress: spatial dependence

2007-2015	Basic Spatial Models			
	OLS		IV1 Enclave	
VARIABLES	gs2sls spatial	MaxLike Spatial	IV1_SPErr + CAFOs	IV1_SPDep + CAFOs
Specs #	(1)	(2)	(3)	(4)
Amish trend	-0.0112	-0.0114	-0.0544***	-0.0484***
	(0.0083)	(0.00826)	(0.0163)	(0.00776)
Constant	9.322***	9.326***	9.119***	8.907***
	(0.306)	(0.305)	(0.314)	(0.291)
Observations	6806	6806	6806	6806
Spatial Error	YES	YES	YES	
SpDepVar				YES

- Basic spatial autoregressive models seemed to have AT coefficients being statistically significant, but these models' strong distribution assumptions are sensitive to parameters set by the researcher
  - Results are sensitive to standard errors and acre weights
    - County-year two-way clustering
    - Spatial standard errors and lag models
  - Rising attention in spatial econometrics and hedonic modeling.
  - Alternative models: Mixed Geographically Weighted Regression (MGWR) and General Additive Models family (GAM).
  - Spatially varying coefficients and smoothing function – semi parametric.

Work in progress: Quantile Regression



2007-2015	OLS Reg	Quantile regression		
Quantile	Mean	At 0.25 quantile	At 0.50 quantile	At 0.75 quantile
Amish trend	-0.0192***	-0.0195***	-0.0143***	-0.0182***
	(0.0055)	(0.0058)	(0.0050)	(0.0041)
Constant	9.5100***	8.5866***	9.6251***	10.2486***
	(0.2433)	(0.2019)	(0.2586)	(0.2671)
Observations	6806	6806	6806	6806

Note: none of the 0.25, 0.50, and 0.75 coefficient is statistically significant from OLS.

- Farmland appraisers have suggested that the presence of Amish farming communities effectively provides a “price floor” in farmland markets,
- The quantile regression model (without IV) is similar to OLS, but with a stronger negative relationship of Amish density and prices as farmland price percentile rises.
- Only the very high percentile seemed to be weakly different from OLS, inferring that the higher percentile prices farmland is more negatively impacted by Amish density.
- Further work: including IV in quantile regression.

Conclusion

- Plain sects, including the Amish, are growing and prospering in several states that also have strong commercial/conventional agriculture. Land market activity allows us to better understand their growth, given other data limitations
- Amish community density does **not** have a statistically significant relationship with farmland prices.
  - Even though Amish limit their adoption of modern production technologies, they successfully compete for farmland with conventional farmers.
  - Amish farmers' competitiveness appears to stem from their religious traditions
    - Lower labor costs, which allows for higher savings/lower return to management, are key differences from conventional farms. Lower capital expenses may also play a role, although older technology may be less efficient.
  - Our identification strategy is designed to mitigate the impact of endogenous growth of Amish settlements and may be replicable in other settings.

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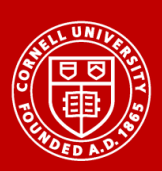

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