You always take the weather with you: The role of climate in determining agricultural land prices

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Motivation

Climate change has uncertain implications for the productivity of agricultural land

Little work done in NZ linking climate, agricultural productivity, and land values

We examine relationship between climate and agricultural productivity as reflected in farmland values

Previous literature

Hedonic studies of farmland values emphasising climate

- E.g. Mendelsohn et al. (1994), Schlenker et al. (2005; 2006)

NZ based studies of farmland values

- Stillman (2005), Grimes and Aitken (2008)

Relationship between profitability and rural land values

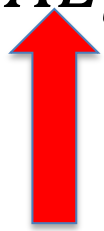
- Allan and Kerr (2015)

Conceptual framework

Basic framework – Ricardian

$$LV_{it} = \sum_{s=0}^{\infty} \frac{E\left(\pi_{i,t+s}\right)}{(1+r)^{t+s}}$$

$$\pi_{it} = p_t \cdot Q(X_{it}, AL_i) - c(X_{it})$$



Climate enters the profit function by affecting the productivity of land

Conceptual framework

Farmland is more than a productive input, also serves as home site

- Climate can make a particular piece of land a nicer place to live

$$LV_{it} = \sum_{s=0}^{\infty} \frac{E\left(\pi_{i,t+s}\left(p_{t+s}, X_{i,t+s}, AL\right)\right)}{r} + M(n, b)$$

Climate is a natural amenity and will affect the amenity value of farmland

Empirical strategy

Climate affects both the productive and amenity value of land

- Difficult to separate the two empirically

We exploit the different channels through which climate affects farmland values

Empirical strategy

First step – OLS estimation

$$\ln(LV_i) = \beta_0 + Prodclim_i\beta + Amenclim_i\theta + X\sigma$$

Two-step estimation procedure

$$\ln(Profits_i) = \alpha + Prodclim_i\zeta + Amenclim_i\lambda + X\gamma$$

$$\ln(LV_i) = \delta + \varphi \ln\left(\widehat{Profits_i}\right) + Amenclim_i\theta + X\xi$$

Can we find evidence that this is a valid exclusion restriction?

Data

Land values

- QVNZ meshblock-level valuations database

Profits

- Dairy – MPI monitor farm
- Sheep/beef – Beef and Lamb Economic Service economic survey
- Expected forest profits from Kerr and Olssen (2012)
- Create MB level average, weighted by observed 2002 land-use shares

Climate

- Productive – growing season growing degree days, rain days, solar radiation, days of soil moisture deficit
- Amenity – average winter and summer temperature, annual sunshine hours, average annual wind speed, average annual rainfall
- Averages over years 1981-2010, pixel level data aggregated to MB

Other controls

- Soil characteristics, distance to amenities
- Pixel level data, aggregated to MB

Results – OLS

	$\ln(Rural\ value\backslash ha)$	$\ln(Profits\backslash ha)$
$GDDs\ (100s)$	0.276***	0.267***
$GDDs^2$	-0.00534***	-0.00567***
$Raindays$	0.0232***	0.00743***
$Solar\ Radiation$	0.0145**	0.0148***
$Days\ smd$	-0.00250**	-0.00633***
$Avg.summer\ temp$	-0.00989	-0.0292
$Avg.winter\ temp$	-0.0270	-0.0199
$Sunshine\ hrs$	0.000211	-0.000174
$Wind\ spd$	-0.0655***	-0.0341***
$Rainfall$	-0.0387***	-0.00388
$Soil\ characteristics$	Y	Y
$Distances$	Y	Y
N	5264	5264
$\overline{R}^2$	0.603	0.456

Conclusions and next steps

OLS results suggest that we can separate the two effects of climate

- We can identify a clear effect of climate on productivity
- Climate amenity value appears relatively unimportant

Over-identification tests suggest more work needs to be done to properly identify coefficients of interest

- Our profit measure ignores value of option to convert