Two papers on Organic Efficiency using SFA

Mayen, C.D., Balagtas, J.V., & Alexander, C.E. (2010)

- Questions:
    1. Can organic and conventional dairy production be treated as having unique technologies?
    2. How do measures of technical efficiency compare when computed against the appropriate technology versus a meta-frontier?
- Contributions:
    1. Handles self-selection into organic using selection on observables (PSM)
    2. Formal test of organic and conventional technologies after controlling for selection
    3. Comparison of efficiency results with and without appropriate technological frontiers

Methods (conceptual)

- SFA
    - normal distribution of error term and half-normal distribution of inefficiency
    - heteroscadasticity in both (using different exogenous parameters)
        - reference Hadri, German, and Whittaker (2003)

        - Note that they write out the log-likelihood function given their parametric assumptions and the measure of technical efficiency.
        - Cobb-Douglas production function
    - Propensity Score Matching: self-selection into organic production
        - Might be concerned that estimated differences in technology are actually capturing differences in the characteristics of operators who choose to opt into organic farming.
        - propensity score matching is a selection-on-observables approach to handling endogenous regime selection
        - the main limitation to PSM is that we cannot select on unobservables, the authors address this limitation at the bottom of pg. 184
    - final model is a three step procedure:
        - (1) probability model - they use Probit
        - (2) match each organic farm to probability neighbors - they use single nearest neighbor, so that each organic farm is compared with one conventional farm and this is the farm with the nearest p(organic) value given their observable characteristics.
        - (3) SFA using remaining in-sample observations.

Why do we have N=137 for the matched conventional farms?

What do we see when we compare means in the variables used in the profit analysis?

Table 1. Description, Units, and Statistics for Variables Included in the Study

	Organic ($N = 288$)		Conventional ($N = 1,194$)		Matched Conventional[a] ($N = 137$)	
Inputs and Output per Cow	Mean	*SE*	Mean	*SE*	Mean	*SE*
Herd size (cows)	81.1	*12.7*	140.1	*8.7*	65.3	*5.6*
Milk production	12,333	*225*	17,0	*153***	14,81	*422***
Feed (lb/Year)	11,457	*414*	15,1	*242***	14,14	*633***
Labor (hrs/Year)	93.9	*3.2*	81.1	*1.5*	102.5	*4.5*
Capital costs ($/Year)	305	*8*	300	*3*	297	*8*
Other inputs ($/Year)	428	*20*	578	*11**	500	*23*
Pasture acres (Acres)	1.62	*0.07*	0.61	*0.03**	1.22	*0.12*
Operator and farm						
Upper Midwest (1/0)	0.44	*0.03*	0.41	*0.01**	0.44	*0.04*
East (1/0)	0.41	*0.03*	0.27	*0.01**	0.40	*0.04*
Cornbelt (1/0)	0.09	*0.02*	0.15	*0.01**	0.05	*0.02**
West (1/0)	0.06	*0.01*	0.11	*0.01**	0.06	*0.02*
Southwest (1/0)	0	*0*	0.02	*0.01**	0.01	*0.01**
Southeast (1/0)	0	*0*	0.06	*0.01**	0.04	*0.02**
Parlor (1/0)	0.40	*0.03*	0.49	*0.01**	0.19	*0.03**
Automatic Takeoffs	0.23	*0.02*	0.37	*0.01**	0.19	*0.03*
Years in Dairy	20.8	*0.7*	23.4	*0.4*	25.0	*1.1*
Years in Organic	5.1	*0.2*	0	*0*	0	*0*
Cow Weight (Lb)	1,177	*11*	1,29	*6****	1,239	*16**
Pasture-based (1/0)	0.88	*0.02*	0.30	*0.01**	0.44	*0.04**
Age (Years)	48.4	*0.6*	51.2	*0.3*	52.1	*0.9*
Years in Industry	23.0	*0.7*	25.9	*0.4*	28.0	*1.0*
College education	0.19	*0.02*	0.16	*0.01**	0.12	*0.03**
Off-Farm work	130	*28*	143	*14*	134	*32*
Planning Horizon (1/0)	0.66	*0.03*	0.48	*0.01**	0.46	*0.04**
Management practices						
Use of rbST (%)	0	*0*	8.0	*0.6**	2.0	*1.0*
Veterinary (1/0)	0.39	*0.03*	0.70	*0.01**	0.41	*0.04**
Nutritionist (1/0)	0.45	*0.03*	0.73	*0.01**	0.51	*0.04**
DHIA participation (1/0)	0.48	*0.03*	0.47	*0.01*	0.29	*0.04**
Seasonal dry-off (1/0)	0.12	*0.02*	0.21	*0.01**	0.26	*0.04**
Farm-raised herd (%)	96.7	*0.9*	92.7	*0.7*	92.9	*1.9*
Farm-raised Feed (%)	68.1	*1.7*	66.1	*0.8*	70.3	*2.2*
Rented Land (%)	33.1	*1.9*	30.3	*0.9*	31.7	*2.3*

Note: Asterisks denote a statistically significant difference with the organic mean at the 10 percent (*), 5 percent (**), and 1 percent (***) levels.
[a]The subsample of conventional farms matched to organic farms on the basis of the estimated likelihood, or propensity, to produce organic milk.

Table 2. Probit Estimates of the Propensity to Produce Organic Milk

	Coefficient	*S.E.*
Constant	13.146	*2.419****
East	0.231	*0.117***
West	0.459	*0.172****
Cornbelt	−0.499	*0.165****
Pasture acres per cow	0.345	*0.044****
Cows	−0.371	*0.079****
Farm-raised feed	0.128	*0.052***
Rented land	0.073	*0.031***
Cow weight	−1.407	*0.292****
Parlor	−0.419	*0.132****
Automatic takeoffs	−0.025	*0.131*
Years in dairy production	0.063	*0.127*
DHIA participation	0.272	*0.109***
Veterinary services	−0.524	*0.111****
Nutritionist	−0.458	*0.117****
Seasonal dry-off	−0.939	*0.139****
Age	−0.753	*0.339***
Planning horizon	0.493	*0.109****
College education	0.129	*0.126*
McFadden Pseudo R - Squared		0.419
Conventional dairy farms correctly predicted		96%
Organic dairy farms correctly predicted		57%

Note: Asterisks denote statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

How do SFA results compare after PSM compared with before? (Is this what you would expect?)

Table 3. Stochastic Production Frontier Estimates, PSM Subsample[a]

	Same Technology		Different Technology	
Technology Model	Coefficient	*S.E.*	Coefficient	*S.E.*
Constant	4.463	*0.992***	4.699	*1.031****
Cows	0.893	*0.065****	0.946	*0.072****
Feed	0.153	*0.035****	0.136	*0.038****
Labor	0.027	*0.033*	0.025	*0.036*
Capital costs	−0.008	*0.060*	−0.013	*0.063*
Other inputs	0.124	*0.022****	0.115	*0.023****
Organic			−1.969	*1.162**
Organic × cows			−0.119	*0.151*
Organic × feed			0.010	*0.078*
Organic × labor			0.044	*0.087*
Organic × capital			0.158	*0.126*
Organic × other			0.028	*0.075*
West	0.025	*0.070*	0.022	*0.071*
Southwest	0.229	*0.190*	0.204	*0.192*
Southeast	0.399	*0.093****	0.391	*0.099****
Cornbelt	−0.057	*0.059*	−0.062	*0.060*
East	0.059	*0.035**	0.053	*0.037*
Use of rbST	0.023	*0.025*	0.024	*0.026*
Cow Weight	0.597	*0.095****	0.586	*0.099****
Parlor	−0.013	*0.048*	−0.019	*0.049*
Years in dairy	0.041	*0.047*	0.036	*0.049*
Pasture-based	0.023	*0.032*	0.043	*0.034*
Farm-raised herd	0.020	*0.037*	0.017	*0.035*
Farm-raised feed	−0.067	*0.027***	−0.067	*0.027***
Rented land	−0.043	*0.009****	−0.041	*0.009****
College education	−0.016	*0.047*	−0.018	*0.047*
Years in industry	0.163	*0.166*	0.199	*0.168*
Years in industry	−0.034	*0.029*	−0.041	*0.029*
Age	−0.518	*0.121****	−0.518	*0.121****
Off-farm work	0.026	*0.008****	0.026	*0.008****
Variance of v				
Intercept	−0.936	*0.746*	−1.009	*0.753*
Cows	−0.623	*0.206****	−0.603	*0.215****
Variance of u				
Intercept	−5.311	*1.710****	−5.998	*1.997****
Cows	0.633	*0.364**	0.784	*0.425**
Log likelihood	0.808		5.459	

Note: Asterisks denote statistical significance at the 10% (*), 5% (**), and 1% (***) levels.
[a]The PSM subsample comprises all organic farms and matched conventional farms.

Table A1. Stochastic Production Frontier Estimates, All Farms

	Same Technology		Different Technology	
Technology Model	Coefficient	*S.E.*	Coefficient	*S.E.*
Constant	6.345	*0.369****	6.439	*0.368****
Cows	0.799	*0.022****	0.804	*0.022****
Feed	0.072	*0.012****	0.069	*0.012****
Labor	0.020	*0.014*	0.019	*0.014*
Capital costs	0.054	*0.021*	0.055	*0.021*
Other inputs	0.116	*0.011****	0.114	*0.011****
Organic			−1.824	*1.271**
Organic × cows			−0.130	*0.143*
Organic × feed			0.106	*0.088*
Organic × labor			0.053	*0.099*
Organic × capital costs			−0.012	*0.136*
Organic × other input			0.041	*0.088*
West	−0.022	*0.027*	−0.023	*0.027*
Southwest	−0.138	*0.044****	−0.142	*0.044****
Southeast	−0.003	*0.028*	−0.007	*0.027*
Cornbelt	−0.036	*0.022*	−0.038	*0.022**
East	0.017	*0.018*	0.017	*0.018*
Use of rbST	0.035	*0.006****	0.035	*0.006****
Cow Weight	0.348	*0.032****	0.341	*0.032****
Parlor	−0.029	*0.020*	−0.029	*0.020*
Dairy production	0.022	*0.017*	0.021	*0.017*
Pasture-based	0.024	*0.016*	0.031	*0.016**
Farm-raised herd	0.007	*0.009*	0.008	*0.009*
Farm-raised feed	−0.005	*0.007*	−0.005	*0.007*
Rented land	−0.021	*0.004****	−0.020	*0.004****
College education	−0.006	*0.019*	−0.005	*0.019*
Years in industry	0.087	*0.068*	0.089	*0.068*

continued

Final take-aways:

Table 4. Means and Standard Deviations of Technical Efficiency

	Organic		Conventional		
	Mean	SE	Mean	SE	Difference in Means
PSM Subsample					
Different	81.7	*6.25*	83.6	*6.70*	−1.87
Same	78.1	*6.48*	83.2	*6.62*	−5.09***
All farms					
Different	77.0	*7.53*	79.4	*3.25*	−2.36***
Same	68.4	*8.13*	79.4	*3.23*	−11.04***

Note: Asterisks denote statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Lohr, L. & Park, T.A. (2006)

- Questions:
    1. What factors affect the technical efficiency of organic farmers?
    2. In particular, do access to soil-improving inputs and producer experience have a significant effect on technical efficiency?
- Contributions:
    1. ?? Not very clear…

Methods

- translog SFA, why translog?
- includes inputs and weather covariates that are treated as inputs - does this seem correct? What might be an alternative way to include the weather parameters?
- I still can't figure out what specification they are using - I think just corrected OLS though? Definitely no heterogeneity
- Compare new and experienced farmers using separate technologies. In a similar vein to the previous paper, what would have been one simple extension here to provide more compelling results?

Table 3. Overall Efficiency and Decomposition by Experience and Soil-Improving Inputs

	Observations	Overall Efficiency[a]	Minimum	Maximum
New organic farmers[b]	215	0.760	0.617	1.000
Overall farming experience				
Fewer than 5 years	97	0.713	0.617	0.818
5 to 10 years	30	0.722	0.633	0.828
10 to 20 years	33	0.789	0.681	0.913
More than 20 years	55	0.847	0.719	1.000
Use of soil-improving inputs				
No inputs	51	0.709	0.617	0.849
1 or more inputs	164	0.776	0.650	1.000
100% reliance	77	0.828	0.742	1.000
Experienced organic farmers[b]	559	0.713	0.598	1.000
Overall farming experience				
5 to 10 years	151	0.660	0.598	0.732
10 to 20 years	195	0.698	0.620	0.779
More than 20 years	213	0.765	0.668	1.000
Use of soil-improving inputs				
No inputs	66	0.700	0.598	0.942
1 or more inputs	493	0.714	0.612	1.000
100% reliance	202	0.745	0.660	1.000

[a] Overall efficiency computed using value shares following Färe and Zelenyuk (2003).
[b] New organic farmers have less than 5 years experience in organic farming. Experienced organic farmers have more than 5 years in organic farming. Total sample size is 774.