Staple to Cash Crop Production in Mexico after NAFTA: Effect of PROCAMPO

Joanne R. Henderson, Kathy Baylis and Jason Barton

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Have decoupled income payments, PROCAMPO facilitated the switch from staples to cash crop production?

- Concern about staple producers and conversion costs
- Much work on affect of decoupled payments in US and EU.
- Little done in developing countries where credit constraints may matter.
What we do

• Examine crop choice since NAFTA
  – Poverty: Cord and Wodon (2001); Sadoulet and de Janvry (2001); Yunez-Naude and Taylor (2006)

• County-level data
  – Greater number of observations (1,400 counties)
  – Can observe regional distribution

• More recent years (2001 and 2003)
  – Previous studies used data from 1997/98
Hypotheses

- NAFTA will lead producers to transition to cash crop production.
- The shift to decoupled income payments, PROCAMPO, allows producers to switch crops.
- Areas closest to the United States border will see a greater movement to cash crop production after NAFTA.
PROCAMPO

• Per hectare payment
  – Paid on nine staple crops planted during the 1993/1994 agricultural year
  – 950 pesos per hectare in 2003 ($90USD)
• In 2003, 2.8 million farmers received 13 billion pesos for 13.7 million hectares of land
• “Anticipated” and “Capitalized” PROCAMPO
• Future of PROCAMPO
Data

National Institute of Statistics, Geography and Information (INGEGI)

- Infrastructure and economic data
  - Economic censuses of 1989, 1999, and 2004
  - General population censuses of 1990, 2000, and 2005

- Agricultural data
  - 1991 agricultural census

- Government payment data
  - PROCAMPO, other government payments, credit data, the annual agricultural yearbooks for 2000/2001 and 2002/2003
  - PROGRESA/ Oportunidades 2002 and 2003
Staple Crops Include:

- Barley
- Beans
- Corn
- Cotton
- Rice
- Sorghum
- Soy
- Sunflower
- Wheat

Percent of Crop Land Planted in Staples

1991

Percent of Crop Land Planted in Staples

2003

Staple Crops Include:
Barley, Beans, Corn, Cotton, Rice, Sorghum, Soy, Sunflower and Wheat

Created March 22, 2010
Joanne R. Henderson
University of Illinois
County Homogeneity

- Data is at the county level
- Examine micro-level data from 1991 census
- Variation within counties and between counties

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Wage</td>
<td>1,095,499</td>
<td>2,124,893</td>
</tr>
<tr>
<td>Education</td>
<td>0.6909</td>
<td>0.7444</td>
</tr>
</tbody>
</table>

- Similar physical constraints
  - elevation, temperature, precipitation
Econometric Model

\[ \frac{l_s}{l} = f(p_s, p_c, r_c, k_c, g) \]

\( \frac{l_s}{l} \) = change in land planted in staples
\( p_s, p_c \) = local market demand \( \rightarrow \) local population, local wages
\( r_c \) = transportation cost \( \rightarrow \) distance to the US border
\( k_c \) = transition cost \( \rightarrow \) education, infrastructure index
\( g \) = policies \( \rightarrow \) PROCAMPO, PROGRESA, other government payment

(Weighted by the total agricultural land in each county)
## Percent of land in staples

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weighted Fixed Effects</td>
<td>Weighted Random Effects</td>
</tr>
<tr>
<td>ln(PROCAMPO payment per producer)</td>
<td>-0.087 (0.030)</td>
<td>0.017 (0.0001)</td>
</tr>
<tr>
<td>ln(other government payments per farm)</td>
<td>0.037 (0.011)</td>
<td>0.036 (0.00004)</td>
</tr>
</tbody>
</table>

**Government Policies**
## Percent of land in staples

<table>
<thead>
<tr>
<th></th>
<th>Before NAFTA</th>
<th>After NAFTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(population in thousands)</td>
<td>0.265</td>
<td>0.272</td>
</tr>
<tr>
<td></td>
<td>(0.131)</td>
<td>(0.122)</td>
</tr>
<tr>
<td>ln(wages per worker)</td>
<td>-0.03</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>ln(distance to the US border 1000km)</td>
<td>0.016</td>
<td>0.086</td>
</tr>
<tr>
<td></td>
<td>(0.0003)</td>
<td>(0.020)</td>
</tr>
</tbody>
</table>

Local Market Demand Transportation Costs
Percent of land in staples

<table>
<thead>
<tr>
<th>% of population with a high school education</th>
<th>Coef</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of population with a high school education</td>
<td>-2.049</td>
</tr>
<tr>
<td>infrastructure index (drainage and sanitation)</td>
<td>-0.047</td>
</tr>
</tbody>
</table>

Transition Costs
Robustness Tests

- Revenue per hectare
- Other variables
  - Literacy
  - Cities with a population over 100,000
- Homogeneity test
- Tobit regression
- *Ejidal* lands and PROGRESA areas
### Percent of land in staples

<table>
<thead>
<tr>
<th></th>
<th>Ejido</th>
<th>Progressa</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(PROCAMPO payment per producer)</td>
<td>-0.100</td>
<td>-0.0003</td>
<td>-0.087</td>
</tr>
<tr>
<td></td>
<td>(0.033)</td>
<td>(0.055)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>ln(other government payments per farm)</td>
<td>0.057</td>
<td>0.009</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>(0.185)</td>
<td>(0.014)</td>
<td>(0.011)</td>
</tr>
</tbody>
</table>
Credit Model

credit = f(government payments, county characteristics)

where:

government payments = PROCAMPO, PROGRESA, and other government payments

county characteristics = wages per worker, high school education, and infrastructure index
Credit Model

<table>
<thead>
<tr>
<th>log(Credit Payment Total)</th>
<th>Fixed Effects</th>
<th>Random Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(PROCAMPO payment total)</td>
<td>23.61**</td>
<td>0.531***</td>
</tr>
<tr>
<td>log(PROGRESA payment total)</td>
<td>-2.959</td>
<td>-0.883***</td>
</tr>
<tr>
<td>log(other government payments total)</td>
<td>-0.265</td>
<td>-0.163***</td>
</tr>
<tr>
<td>log(wages per worker)</td>
<td>-0.0246</td>
<td>0.607***</td>
</tr>
<tr>
<td>% of pop. with a high school education</td>
<td>-106.9</td>
<td>11.02***</td>
</tr>
<tr>
<td>infrastructure index (drainage &amp; sanitation)</td>
<td>-16.63**</td>
<td>-3.966***</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1
Conclusions

• Some evidence that PROCAMPO has assisted producers in switching to cash crop production
• The existence of other government payments to agriculture may have slowed conversion
• Effect of PROCAMPO is larger for *ejido* producers, benefits are not constrained to larger producers
• After NAFTA, areas closer to the border have seen a greater movement to cash crop production
Implications for Canada

• Future trade agreements with developing countries can be facilitated by transition payments
• Provide payment prior to planting
• Focus on infrastructure development
• Invest in human capital