APPENDIX B: DATA

Creating the Dataset

Observations kept

To construct the dataset, we undertake a number of steps. We retain observations with a household identifier for which the data are non-empty for at least some of the variables of interest. This leaves 1,437 observations.

We remove households that report living in different municipalities (91 observations), households that have different values for distance to Ouro Preto do Oeste (47 observations) and households for which this variable is missing (62 observations). Following, we also remove lots added to the sample in 2009 (327 observations) and lots and households only observed once (71 observations, since we use a fixed effects estimator) and all of the observations from 1996 (162 observations, since beef prices are unavailable in 1996). Then, given that there are some missing data for some of the controls and some of the dependent variables, the full sample consists of 666 observations.

Created variables and data transformations

Our analysis relies upon variables which had to be created using the existing data. These variables are constructed as follows:

1) Non-dairy cattle – This variable is defined as the total amount of cattle on the lot minus the total number of dairy cattle on the lot;

2) Dairy and non-dairy cattle stocking densities – Total number of (dairy or non-dairy) cattle in the lot divided by total area of the lot net of primary forest (GIS estimates);

3) Proportion of land under pasture, primary forest, total forest and secondary forest – Total land under the land-use divided by total (GIS) lot size;

4) Deflators – Real prices are given for the prices of milk but not for beef. We thus divided the real price of milk in the wet season by its nominal price. When not available, the average municipal deflator is used;

5) Real Beef prices - Multiply the nominal beef price by the calculated deflator;

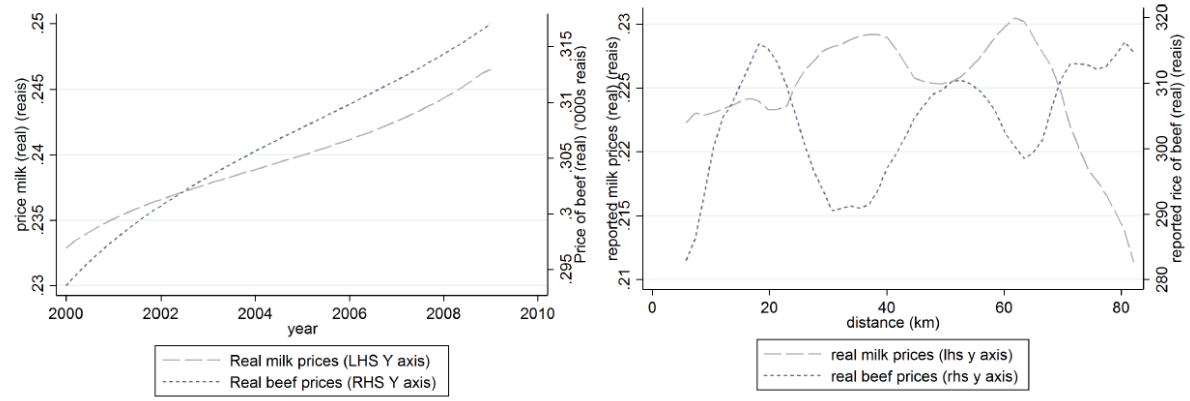
6) Milk and beef prices – The real wet season milk prices and beef prices used are calculated using the unweighted municipal average of the reported prices in a given municipality in a given year. Note, for the purposes of the paper the beef price variable is further transformed by dividing the beef price by 1,000. The reason for doing this is that it makes the interpretation of the coefficients more straightforward;

7) Asset index – Assets owned by the household, e.g. cars, motorbikes, bicycles, televisions, etc., indexed between zero and one, as a proxy for household wealth. The index is constructed using the first component of Principal Component Analysis.

Trends and spatial patterns of key variables

The left-hand panel of Figure B1 depicts the price trends of beef and milk (the latter recorded in the wet season) over the sample period. The local polynomial of real milk prices (on the left-hand y-axis), shows a consistent increase in the average price of milk over our sample period. Between 2000 and 2009, average milk prices increased by 21%, from 19 cents per litre to 23 cents per litre. Real beef prices increased by approximately 34% between 2000 and 2009. The right-hand panel of Figure B1 shows that beef and milk prices vary widely over space.

Figure B.1: Milk and beef prices



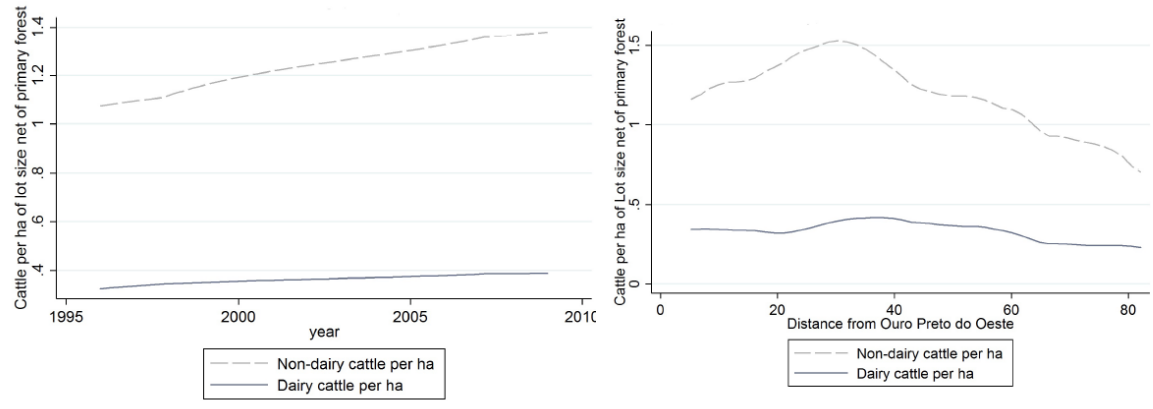
(a) average municipal prices over time, 2000-2010

(b) reported prices by distance from Ouro Preto do Oeste, km

Note: Beef prices refer to the price per steer sold. Milk price refers to the price per litre.

Figures B2, B3 and B4 depict time trends in cattle stocking density and land-use change and shows how these variables change with distance to market. Cattle stocking density, in Figure B2, is defined as the total number of each cattle type (dairy, non-dairy) per ha of total lot area net of primary forest. The pattern in the left-hand panel suggests an increase in cattle stocking density over time, more so for non-dairy cattle. Non-dairy cattle have a more than three-fold higher stocking density than dairy cattle. The right-hand panel suggests that, on average, cattle stocking density declines as we move further away from the market.

Figure B.2: Cattle stocking density

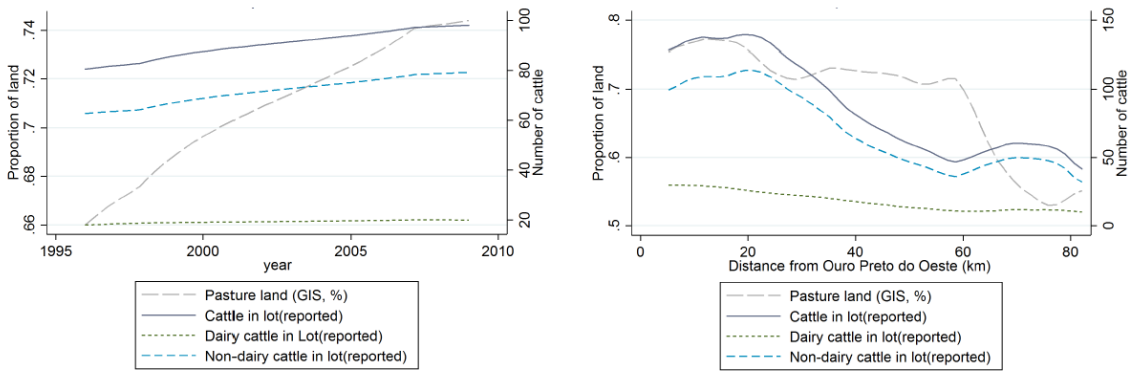


(a) over time, 2000-2010

(b) by distance from Ouro Preto do Oeste, km

Figure B3 highlights changes in the proportion of land under pasture and the number of cattle (disaggregated by type) on the lot over the sample period. The panel on the left-hand side suggests a sharp increase in the land area under pasture and an associated increase in the number of cattle in the lot. This increase is mostly driven by expansion of the non-dairy cattle herd. Indeed, on average, non-dairy herds are larger than dairy herds by a factor of four. The majority of sampled households engage in dual-purpose cattle production, owning both non-dairy and dairy cattle. The right-hand-side panel of Figure B3 suggests that households living further away from market tend to allocate smaller proportions of land to pasture and own smaller numbers of cattle.

Figure B.3: Proportion of land under pasture and number of cattle in the lot

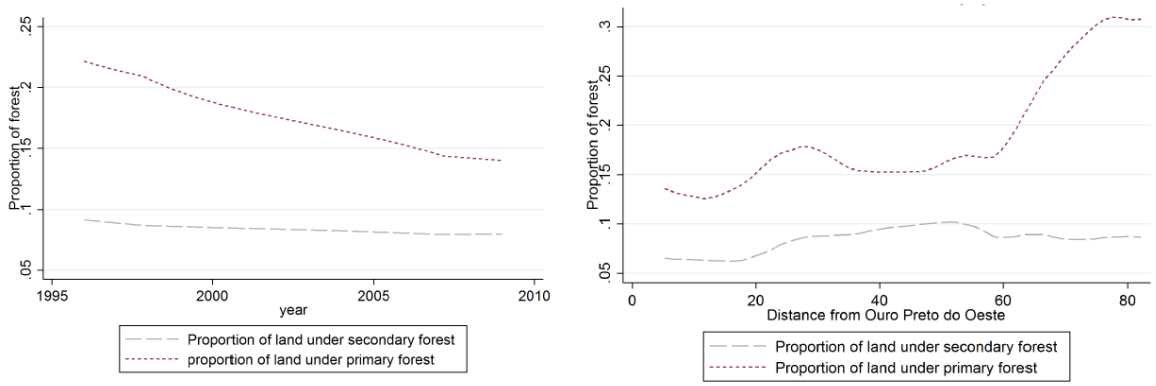


(a) over time, 2000-2010 (b) by distance from Ouro Preto do Oeste, km

Figure B4 illustrates patterns of forest cover over time and space. The left-hand panel of Figure B4 suggests a consistent trend of deforestation throughout our sample period, which led to the average proportion of land under primary forest declining among households. The average proportion of land under secondary forest appears to be relatively stable over time. This is consistent with patterns of secondary forest succession in the Brazilian Amazon, when land used in the past for cultivating annual and perennial crops is fallowed (Caviglia-Harris et al. 2014). While the trend is non-linear, the right-hand panel of Figure B4 shows a clear

pattern of greater forest cover in lots located further away from the centre of Ouro Preto do Oeste.

Figure B.4: Proportion of land under forest cover



(a) over time, 2000-2010

(b) by distance from Ouro Preto do Oeste, km