

Exercise 2: Structural Transformation and Farm Size
(due in class, Thurs. 2/19/2009)

Remember exercise 1? Here again you need to forecast demand in two large developing countries, Indonesia and Nigeria. But now, instead of working for Cargill on demand for food and feed products, you're with John Deere forecasting demand for tractors and farm equipment.

Fortunately you remember from AGECE 340 that farmers' demand for tractors and equipment depends mainly on the change in land area available per farmer. Since total land area stays almost constant, and in these countries farming is what people do when they can't move to urban areas, you can project changes in land per farmer based on changes in the total population minus the urban population.

You decide to make your projections in five-year intervals, starting in 2005. From FAOStat's database on land (faostat.fao.org/site/377/default.aspx) and on population (faostat.fao.org/site/551/default.aspx), you find the numbers already entered in the table below. Your first task is to complete the table, by subtracting urban from total to fill in each year's rural population, and dividing land area by rural population to get land available per rural person.

Table 1. Approximate level of total population and land per rural person, 2005-2025

	<u>Indonesia</u>				<u>Nigeria</u>			
	23 m. hectares				32 m. hectares			
Total arable land:	Total population - (m.)	Urban pop. (m.)	Rural pop. (m.)	Land per rural person (ha/person)	Total population - (m.)	Urban pop. (m.)	Rural pop. (m.)	Land per rural person (ha/person)
2005	222.8	106.7	116.1	0.198	131.5	63.5	68.0	0.471
2010	235.8	125.3	110.4	0.208	146.0	75.8	70.2	0.456
2015	246.8	142.5	104.3	0.221	160.9	89.3	71.6	0.447
2020	255.9	157.6	98.3	0.234	175.8	103.5	72.3	0.443
2025	263.7	170.6	93.1	0.247	190.3	118.1	72.2	0.443

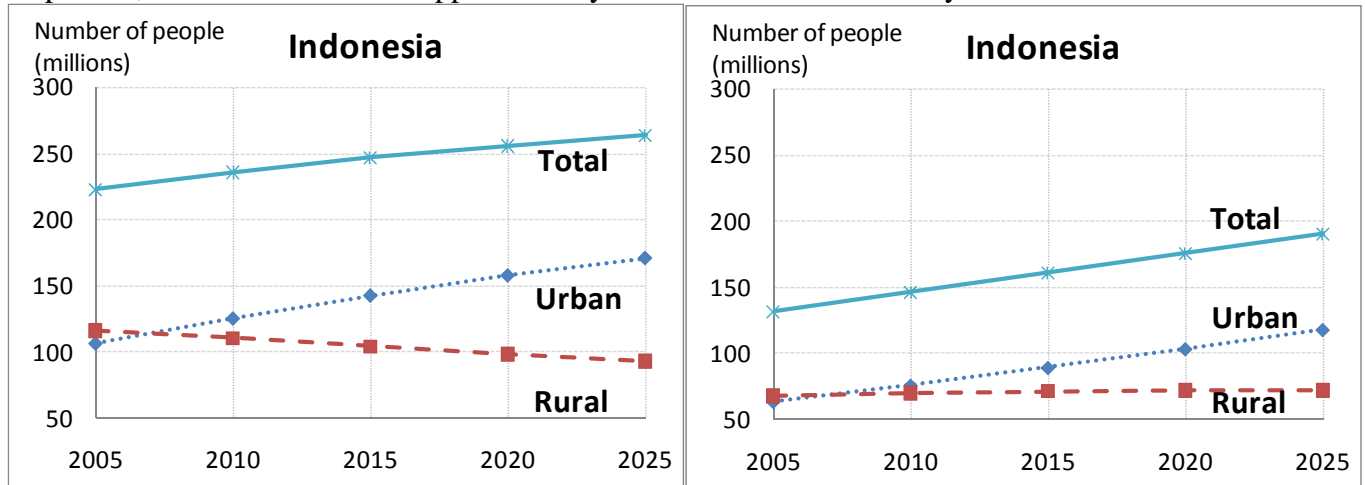
You can see how these translate into approximate annual percentage changes by filling in the table below. For each cell (X), from the initial year *t* and a period of *n* years, the approximate annual growth rate is $([X_{t+n} - X_t]/X_t)/n$.

Table 2. Approximate annual change in population and land per rural person (percent per year)

	<u>Indonesia</u>				<u>Nigeria</u>			
	Total population	Urban pop.	Rural pop.	Land per rural person	Total population	Urban pop.	Rural pop.	Land per rural person
2005-10	1.16%	3.50%	-0.98%	1.03%	2.20%	3.86%	0.65%	-0.63%
2010-15	0.94%	2.74%	-1.11%	1.18%	2.05%	3.57%	0.40%	-0.39%
2015-20	0.73%	2.11%	-1.15%	1.22%	1.85%	3.18%	0.18%	-0.18%
2020-25	0.62%	1.66%	-1.05%	1.11%	1.65%	2.82%	-0.03%	0.03%

Finally, using these numbers you can answer the questions on the following page.

(1) Using Table 1, in the space below please draw charts that show the total, urban and rural populations of Indonesia and Nigeria over this time period, in a way that is similar to the historical chart for the U.S. at the bottom of page 9 of your Week 5 slides. Lines do not need to be precise, but should be drawn approximately to scale and labeled clearly.



Notice that the charts above should cover only a 20-year period from 2005 to 2025, whereas the corresponding chart for the U.S. actually covers the 160-year period from 1820 to 1980.

- (2) One key date in a country’s history is when its growing urban (or non-agricultural) population first grows larger than its rural (or agricultural) population, so the two are equal.
- (a) In the charts above, in about what year will this occur in Indonesia and Nigeria? 2007
- (b) From the class slide, in about what year did this occur in the United States? 1880
- (3) Another key date is the “structural transformation turning point”, when the rural (or agricultural) population stops growing and begins to fall. This has already occurred in Indonesia.
- (a) In the charts above, in about what year will this occur in Nigeria? 2020
- (b) From the class slide, in about what year did this occur in the U.S.? 1910
- (4) These dates depend on the demographic and economic factors in an unexpected way, as shown in Tables 1 and 2. From those data, comparing Indonesia and Nigeria now (2005-2010):
- (b) In which country is the total population growing faster? Nigeria
- (b) In which country is the urban population growing faster? Nigeria
- (c) In which country is the rural population still rising? Nigeria
- (5) If you want to open new dealerships or sell larger equipment, what matters is not how big farms are but whether they are growing. Comparing Indonesia and Nigeria now (2005-2010):
- (a) In which country is land per farmer now larger? Nigeria
- (b) In which country is land per farmer now expanding? Indonesia
- (c) So... in which country would you rather open a new tractor dealership? Indonesia