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Controlling Avian Flu and Protecting People's Livelihoods in Africa and Indonesia

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Assessing the Impact of an Avian Flu Impact in Kenya

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Key Findings

- Even though the poultry sector is only a small part of the Kenyan economy, almost all farmers are connected to poultry production and because of that, their livelihoods are likely to be affected by an avian flu outbreak.
- Increasing the severity, duration and geographic spread of an avian flu outbreak may lead to significantly larger declines in poultry production.
- The economywide costs of a severe and lengthy outbreak translate to a reduction in economic growth of 0.12 percentage points per year and may increase the number of Kenyans living below the poverty line by almost half a million.

While some African countries have not yet experienced outbreaks of highly pathogenic avian influenza (HPAI), they remain vulnerable, both in terms of susceptibility and potential economic losses. Kenya is one of these vulnerable countries. Its position along migratory bird routes and proximity to other high risk countries make Kenya particularly susceptible to a potential HPAI outbreak. The threat of avian flu has caused many households in Kenya to limit their consumption of poultry products and the Kenyan government has also banned poultry imports (Nyaga, 2007; Omiti and Okuthe, 2009). Thus, even without a confirmed outbreak, avian flu may undermine the poultry sector with adverse impacts on agricultural livelihoods.

The implications of avian flu for economic growth and poverty in Kenya raises great concern and merits considerable attention in deciding whether to devote resources towards mitigation efforts. This brief highlights key findings from a study which estimated the economywide impacts that a potential avian flu outbreak may have in Kenya.

Role of Poultry in the Kenyan Economy

Despite Kenya's large industrial and service sectors, most households depend heavily on agriculture for their livelihoods. Livestock as a whole generates about five percent of total GDP while the poultry subsector generates 1.3 percent of total GDP. Three quarters of rural farm households keep indigenous chickens, which

use little labor time and require few inputs. On average, there are 1.23 birds for each farm household member in Kenya (see Table 1). Per capita poultry ownership is higher amongst higher income households and also in the Coastal province. In terms of its share in total farm income, 0.69 percent of farmers' income, on average, is generated from poultry income, and smallholder poultry producers from the Coastal province are most reliant on income from poultry keeping (approx. 2% of total farm household income).

Table 1: Poultry stocks and income shares by expenditure quintile

	All farm households	Farm household per capita expenditure quintiles				
		Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	Average number of birds per farm household member					
Kenya	1.23	0.89	1.17	1.41	1.37	2.19
Central	1.54	0.87	0.94	0.86	1.86	2.75
Coast	1.87	2.08	2.81	4.38	2.56	5.57
Eastern	1.07	0.67	0.88	1.23	1.23	1.79
Nyanza	1.03	0.47	0.95	1.26	0.99	1.83
Rift Valley	1.25	0.78	1.02	1.59	1.23	1.99
Western	1.23	1.20	1.29	0.89	1.46	1.55
	Poultry income share in total farm household income (%)					
Kenya	0.69	2.04	1.89	1.43	0.84	0.23
Central	0.90	1.83	1.31	0.92	1.17	0.67
Coast	2.62	3.65	3.89	3.01	0.91	1.79
Eastern	0.99	1.46	1.21	1.61	1.03	0.47
Nyanza	0.00	0.00	0.00	0.00	0.00	0.00
Rift Valley	0.00	0.00	0.00	0.00	0.00	0.00
Western	0.82	0.86	1.32	1.20	0.53	0.64

Source: Author's calculations using the 2005/06 Integrated Household Budget Survey, and the 2007 Kenyan social accounting matrix (Thurlow, 2008).

Note: Farm households include those with and without poultry. Poultry stocks and incomes are zero in Northeastern and Nairobi provinces because the subsector is a very small share of these regions' total production and so is excluded from our analysis.

There is also a large commercial poultry sector, mostly located near the countries' urban centers. These businesses keep large flocks of broilers and layers and produce around 16 million day-old chicks each year. However, compared to indigenous chicken farming, few Kenyans are employed in the commercial poultry sector. This implies that the impact of avian flu on employment and livelihoods is likely to arise via effects on indigenous breeds and locally produced poultry feed.

Modeling the Economywide impacts of Avian Flu

The dynamic computable general equilibrium (DCGE) is used to capture Kenya's detailed economic structure and illustrates how changes in poultry production and demand affect economic growth and household incomes in the country. This class of economic models is often used to examine external shocks in low income countries, such as droughts. The DCGE explicitly measures structural linkages between producers, households and the government, while also accounting for resource constraints and the role these play in determining product and factor prices. These models do, however, depend on their underlying assumptions and the quality of the data used to calibrate them. The full Kenya DCGE model developed is calibrated to the most recent social accounting matrix and household budget survey (KIHBS 2005/06). It is slightly modified by dropping a number of assumptions implicit

in the simplified model (see Lofgren et al., 2002; Thurlow, 2005). Fifty-three sectors and eight factors of production are identified (see Table 2) and further disaggregated across the country's eight provinces.

Table 2: Sectors, factors and regions in the Kenya DCGE model

Agriculture (24)	Maize; wheat; rice; sorghum; millet; cassava; other roots (incl. sweet potatoes); pulses (incl. mixed beans); oil seed crops (incl. sesame, groundnuts); fruits; vegetables; cotton; sugarcane; coffee; tea; tobacco; other crops (incl. pyrethrum); cattle; dairy; poultry; sheep & goats; other livestock (incl. pigs); fisheries; and forestry
Industry (19)	Mining; meat & fish processing; grain milling; sugar processing; other food processing; beverages & tobacco; textiles & clothing; leather & footwear; wood products (excl. furniture); printing & publishing; petroleum products; other chemical products (incl. plastics); non-metallic minerals (incl. glass); metal products (incl. aluminum); machinery; other manufacturing (incl. furniture); electricity; water; and construction
Services (10)	Wholesale & retail trade services; hotels & catering; transport services; communication services; financial services; business & real estate; community & other private services; government administration and services; education; and health
Factors (8)	High-skilled labor; semi-skilled labor; low-skilled labor; agricultural land; agricultural capital; nonagricultural capital; livestock stocks; and poultry stocks
Provinces (8)	Central; Coast; Eastern; Nairobi; Northeastern; Nyanza; Rift Valley; and Western

Avian flu simulations

Two possible consequences of avian flu are captured in the DCGE model. First, an outbreak of avian flu results in the culling of poultry stocks, which reduces the productive capacity of the poultry sector. Falling poultry production affects household incomes in the model via three channels: (1) direct losses in agricultural revenues for poultry farmers; (2) indirect effects from changes in economywide factor returns; and (3) changes in consumer prices, including that of poultry. The second consequence of avian flu is reduced consumer demand for poultry products. This effect on household incomes is not easily predicted. Poultry farmers will be adversely affected by falling prices which may cause them to shift resources into other activities to offset falling agricultural revenues. At the same time, agricultural production in areas other than poultry could increase thus benefiting other household groups in the model. The net effect will ultimately depend on the economic structure and income distribution of the economy. In our analysis we are able to isolate the effects of production and demand-side shocks. We consider three dimensions of an outbreak in our simulations and examine various scenarios under which these dimensions are altered. The dimensions are summarized in Table 3.

Table 3: Different dimensions of a simulated avian flu outbreak

1. Severity (2 levels)	Minor (15 percent annual decline in poultry production and demand) Major (30 percent annual decline in poultry production and demand)
2. Duration (3 levels)	1 year (2010) 2 years (2010-2011) 3 years (2010-2012)
3. Spread (3 levels)	Localized (high risk districts only) Extensive (high and medium risk districts) Nationwide (all districts)

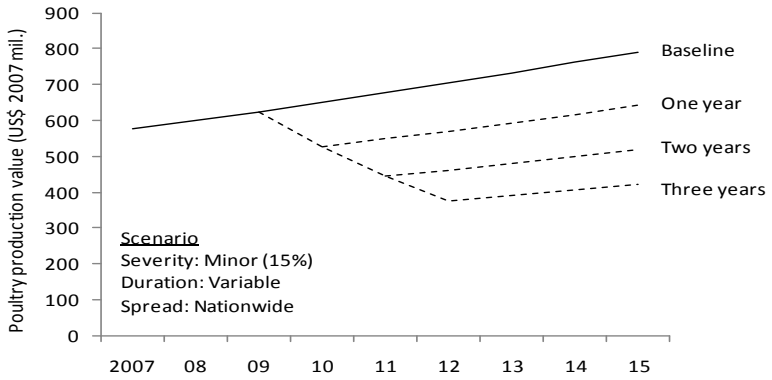
Simulation Results

To estimate the economic impact of avian flu a baseline scenario in the absence of an HPAI outbreak is simulated. This baseline scenario is drawn from current growth and demographic trends and mainly provides a counterfactual scenario against which comparisons can be drawn; it is not meant to influence our conclusions. Starting from this baseline, poultry production and demand is reduced in order to simulate an avian flu outbreak of varying dimensions.

Different Dimensions of an Outbreak

Figure 1 and 2 show the impact of a minor outbreak of different durations and geographical spread, respectively. In the event of a 15 percent reduction in annual poultry production and demand resulting from an HPAI outbreak, the nationwide decline in poultry stocks and production is significantly larger when the duration of an outbreak is lengthened. Figure 1 suggests that poultry production may fall by as much as 47 percent.

Figure 1: Poultry production under avian flu scenarios with variable durations



Source: Results from the Kenya DCGE and microsimulation model.
Notes: Impact of the combined production and demand scenario on the real value of poultry production (measured in 2007 prices).

When geographic spread is allowed to vary rather than duration, which in this scenario is held constant over three years, "localized" outbreaks tend to have a great impact not only because of the significant reduction in production but also because the affected districts account for about half of national poultry production. Production losses are significantly larger under an "extensive" outbreak and only a small additional loss is incurred when an extensive outbreak becomes nationwide.

Figure 2: Poultry production under avian flu scenarios with variable geographic spreads

Source: Results from the Kenya DCGE and microsimulation model.
Notes: Impact of the combined production and demand scenario on the real value of poultry production (measured in 2007 prices).

Table 4 summarizes the impact of an outbreak on poultry production for all three dimensions. Generally, the model results indicate that increasing the severity, duration and geographic spread of an outbreak leads to significantly larger declines in poultry production. In the worst case scenario, national poultry production may reduce by up to 75 percent.

Table 4: Deviation in national poultry production from baseline in 2015 (%)

Severity of Outbreak	Spread of outbreak	Duration of outbreak		
		One year	Two years	Three years
Minor (15%)	Localized	-10.51	-19.61	-27.52
	Extensive	-17.72	-32.27	-44.22
	Nationwide	-18.97	-34.34	-46.80
Major (30%)	Localized	-20.46	-35.61	-47.04
	Extensive	-34.15	-56.52	-71.21
	Nationwide	-36.47	-59.64	-74.36

Source: Results from the Kenya DCGE and microsimulation model.
Notes: Impact of the combined production and demand scenario on the real value of poultry production (measured in 2007 prices).

Economywide Losses and Growth Effects caused by an outbreak

Table 5: Total economic losses due to avian flu (US$ million)

Severity of outbreak	Spread of outbreak	Duration of outbreak		
		One year	Two years	Three years
Minor (15%)	Localized	-38.7	-71.4	-99.0
	Extensive	-61.4	-111.1	-151.3
	Nationwide	-65.2	-117.3	-158.9
Major (30%)	Localized	-76.0	-130.8	-170.8
	Extensive	-118.8	-194.6	-241.6
	Nationwide	-125.7	-203.0	-248.4

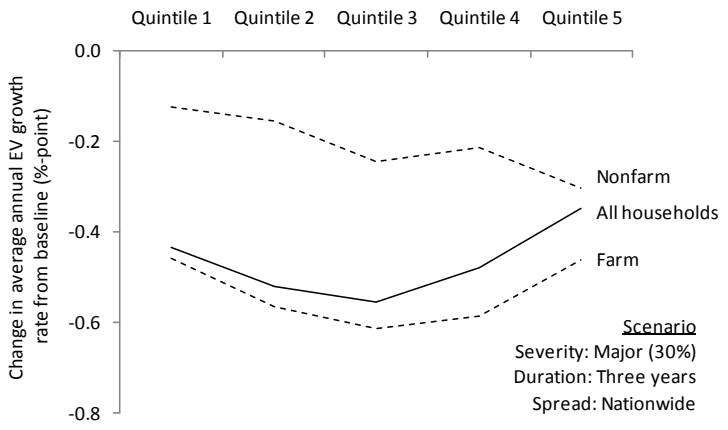
Source: Results from the Kenya DCGE and microsimulation model.
Notes: Impact of the combined production and demand scenario on the real value of total GDP in 2015 (measured in 2007 prices).

An avian flu outbreak could cost the Kenyan economy between US$38 and US$248 million depending on the scale and duration of an outbreak (Table 5). As was the case under poultry production, lengthier and more severe outbreaks may result in significantly larger economic losses. However, these impacts remain very small relative to the overall size of the economy. A major three-year nationwide outbreak reduces the national GDP growth rate by only 0.12 percentage points per year. It is therefore unlikely that an avian flu outbreak would have a severe detrimental effect on economic growth in Kenya.

Household Welfare and Poverty Effects

Even though the effect of an avian flu outbreak may be small on an economywide scale, at the household level, there may be large negative consequences, especially among certain population groups. In terms of average per capita in equivalent variation, which is a household welfare measure that controls for changes in price, a major three-year nationwide outbreak could reduce growth rates by up to 0.54 percentage points among farm households. Figure 3 shows the impact of such an outbreak on household welfare across per capita expenditure quintiles. Households in the middle income group (i.e. quintile 3) are most vulnerable to welfare losses from an avian flu outbreak.

Figure 3: Deviation in national household equivalent variation by expenditure quintile



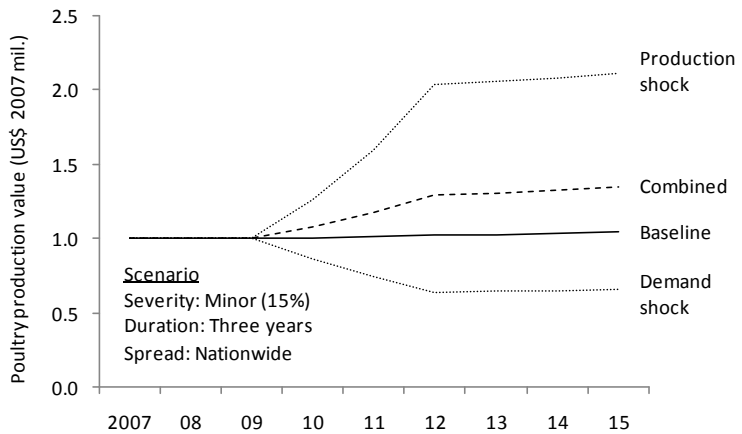
Source: Results from the Kenya DCGE and microsimulation model.
Notes: Equivalent variation is a welfare measure controlling for prices.

The model results also indicate that a severe and prolonged outbreak could increase the number of people living below the poverty line by almost half a million. This would be a major setback for Kenya, where almost half of the population is already considered poor.

Production versus Demand Shocks

The simulations reported so far include both production and demand-side effects of avian flu. However it is possible that households will respond to the threat of avian flu by reducing their demand for poultry products, even if an outbreak has not been confirmed (Kimani et al., 2006 cited in Nyaga, 2008). A fall in demand for poultry products produces different outcomes to those reported earlier. Figure 4 decomposes changes in poultry market prices caused by production and demand-side shocks. Reducing production without lowering demand causes *real* poultry prices to double under a minor three-year nationwide outbreak. Conversely, reducing demand without culling birds causes an over-supply of poultry products and falling market prices. Lower prices benefit those consumers that continue to eat poultry despite the threat of avian flu. It will, however, reduce agricultural revenues for poultry farmers.

Figure 4: Deviation in national household equivalent variation by expenditure quintile



Source: Results from the Kenya DCGE and microsimulation model.

Conclusions

Kenya is vulnerable to avian flu given its position along migratory bird routes and proximity to other high risk countries. This raises concern about the effect an outbreak could have on the country's economic development. This brief made use of a DCGE model of Kenya to simulate potential outbreaks of different severities, durations and geographic spreads. Results indicate that even a severe outbreak does not greatly reduce economic growth. It does, however, significantly worsen poverty, because poultry is an important income source for poor farmers and a major food item in consumers' baskets. Avian flu therefore does pose a threat to future development in Kenya. Reducing an outbreak's duration and spatial transmission is found to substantially lower economic losses. However, losses are still incurred when poultry demand falls, even without a confirmed outbreak. Our findings support ongoing efforts to monitor cross-border poultry trade; undertake rapid testing of possible infections; regulate the disposal of infected birds; and improve both farmers' and consumers' awareness of avian flu. While these measures cannot ensure that an outbreak does not occur, it can greatly reduce the threat that avian flu poses to future development in Kenya.

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