



# How affordable are animal sourced foods?

## Comparisons across 176 countries

---

**Derek Headey**

[d.headey@cgiar.org](mailto:d.headey@cgiar.org)

Senior research Fellow

Poverty, Health and Nutrition Division

International Food Policy Research Institute (IFPRI)

---

# Studies & Researchers involved



Headey, D., Alderman, H. **The relative caloric prices of healthy and unhealthy foods differ systematically across income levels and continents.** Under review.

Headey, D. Headey, D., Hirvonen, K., Hoddinott, J., 2018. **Animal Sourced Foods and Child Stunting.** American Journal of Agricultural Economics.

Andam et al. 2019. Eggs before chickens? **Poultry, poverty and nutrition in sub-Saharan Africa.** AEA Conference paper.

Martin, W., Headey, D. **Dairy markets and child nutrition in the developing world.** AEA Conference paper.

Morris, S.S., Beesabathuni, K., Headey, D., 2018. **An egg for everyone: Pathways to universal access to one of nature's most nutritious foods.** Maternal & Child Nutrition 14, e12679.

Jones, A.D., Delano S.K.V., Headey, D. **The importance of fish for child nutrition in Sub-Saharan Africa.** Unpublished manuscript.

Headey, D. and Palloni, G. 2019. **Vegetarianism and Child Growth: Within-District Evidence from the 2015-2016 Indian National Family Health Survey.** Presentation at ASN Meetings, June 2019.

# The semi-superfluous motivations slide...



## **Why should nutritionists care about ASFs?**

- ASFs are multivitamin-dense foods, high bioavailability
- Small-stomach, rapidly developing infants need nutrient-dense foods
- ASFs can be very kid-friendly in terms of taste, texture, digestibility

## **Why should nutritionists care about ASFs?**

- One might guess that affordability of ASFs varies a lot. Why?
- Variation in perishability, which affects ability to store & transport ASFs
- Scope to reduce ASF prices via food policies\*



# Research questions



- 1. How do child ASF consumption patterns vary across the developing world?**
- 2. Are these ASF consumption patterns associated with child stunting? Are these associations consistent with other evidence?**
- 3. How does the affordability of ASFs vary across the world?**
- 4. Do ASF prices explain consumption differences?**
- 5. Do ASF prices explain stunting differences?**
- 6. What can be done to improve ASF affordability?**



## Child food consumption from DHS

<b>Aggregated food groups in DDS (7 groups)</b>	<b>Disaggregated food groups (12 groups)</b>
(1) Starchy staples	(1) Grains; (2) Roots/tubers
(2) Legumes/nuts	(3) Legumes/nuts
(3) Vitamin-A rich fruits/vegetables	(4) Vit-A rich fruits; (5) Vit-A rich vegetables
(4) Other fruits/vegetables	(6) other fruits/veg (7) dark green leafy vegetables
(5) Dairy	(8) Cow's milk; (9) Infant formula
(6) Eggs	(10) Eggs
(7) Flesh foods	(11) Meat/organs; (12) Fish
	(13) Fortified infant cereals

- **24hr recall, recent surveys**
- **DHS also has information stunting & its determinants (e.g. wealth)**



# Data & Methods: ICP Price data



- ❑ International Comparison Program, 2011
- ❑ Used for estimates of national accounts & income
- ❑ Comparisons require prices!
- ❑ 657 well defined products, including regional foods
- ❑ National average prices
- ❑ Combine with USDA food conversion data (calories)
- ❑ Relative caloric prices:  
=  $\frac{\$ \text{ cost of 1 egg kcal}}{\$ \text{ cost of 1 starchy staple kcal}}$

Food group	N	Examples of specific products
<b>Starchy staples</b>	<b>110</b>	
wheat	41	Various flours, pastas, noodles, breads
rice	36	Coarse, polished, broken, aromatic, etc
maize	18	Maize flour and grains, white/yellow; tortillas
potato	3	Brown, white, frozen
millet	5	Flour, whole grain, couscous, bajra
sorghum	2	Red/white grains
cassava	2	Cassava/manioc/yuka
yam	2	Taro, malanga, yautia, tannia, tannier, macab,
oats	1	Rolled oats
<b>Animal-sourced foods</b>	<b>237</b>	
Milk (bovine)	16	Liquid/powdered, fat contents, cow/buffalo
Other dairy	33	Yoghurt, Cheddar, Haloumi, Kashkaval, Labneh
Eggs	7	Chicken eggs (various sizes), Duck eggs
White meat	24	Chicken, duck; live animal, various cuts; frozen
Red meat, unprocessed	66	Beef, veal, pork, goat, mutton: various cuts
Red meat, processed	10	Hams, sausages, canned meats
Fish/seafood	81	50 distinct species, fresh, fillet, smoked, dried
<b>Total (all foods)</b>	<b>657</b>	

# 1. How do ASF consumption patterns vary?



## Patterns of ASF consumption among children 6-23m in 59 developing countries

Country	N	Fish	Meat	Eggs	Dairy	#1 ASF?
Western Africa	15	26.2%	13.1%	12.6%	23.3%	FISH
Central Africa	5	32.2%	15.7%	8.9%	14.0%	FISH
East African highlands	4	5.7%	7.0%	10.4%	37.1%	DAIRY
Rest of East Africa	12	21.2%	21.3%	15.0%	28.4%	MIXED (low)
South Asia	5	7.4%	8.3%	16.8%	48.5%	DAIRY
Bangladesh		36.5%	13.0%	25.1%	28.3%	FISH
India		4.8%	6.3%	14.4%	50.6%	DAIRY
South-East Asia	3	31.9%	30.0%	31.3%	17.6%	FISH/MEAT
L. America & Caribbean	7	8.8%	50.5%	41.1%	56.9%	DAIRY
E. Europe & C. Asia	5	3.8%	38.1%	37.3%	66.2%	DAIRY
M. East & N. Africa	3	7.8%	21.1%	26.5%	66.9%	DAIRY



## 2. Is ASF consumption associated with stunting?



### i. Any ASF predicts a 4-point reduction in stunting risk by end of first 1000 days

Sample:	6-23m children	6-11m children	12-17 mo children	18-23 mo children
Any ASF	-0.023***	-0.016***	-0.011**	-0.040***

### ii. All ASFs predict lower stunting

18-23 mo children	
Dairy	-0.034***
Eggs	-0.013**
Meat/Fish	-0.021***

### iii. ASF variety predict larger declines

(2)	
1 ASF vs none	-0.037***
2 ASFs vs none	-0.057***
3 ASFs vs none	-0.061***

Notes: 46 countries, 112,553 kids, controls for food groups, other stunting risk factors, sub-national fixed effects, rural area, survey fixed effects

### 3. How does ASF affordability vary across the world?

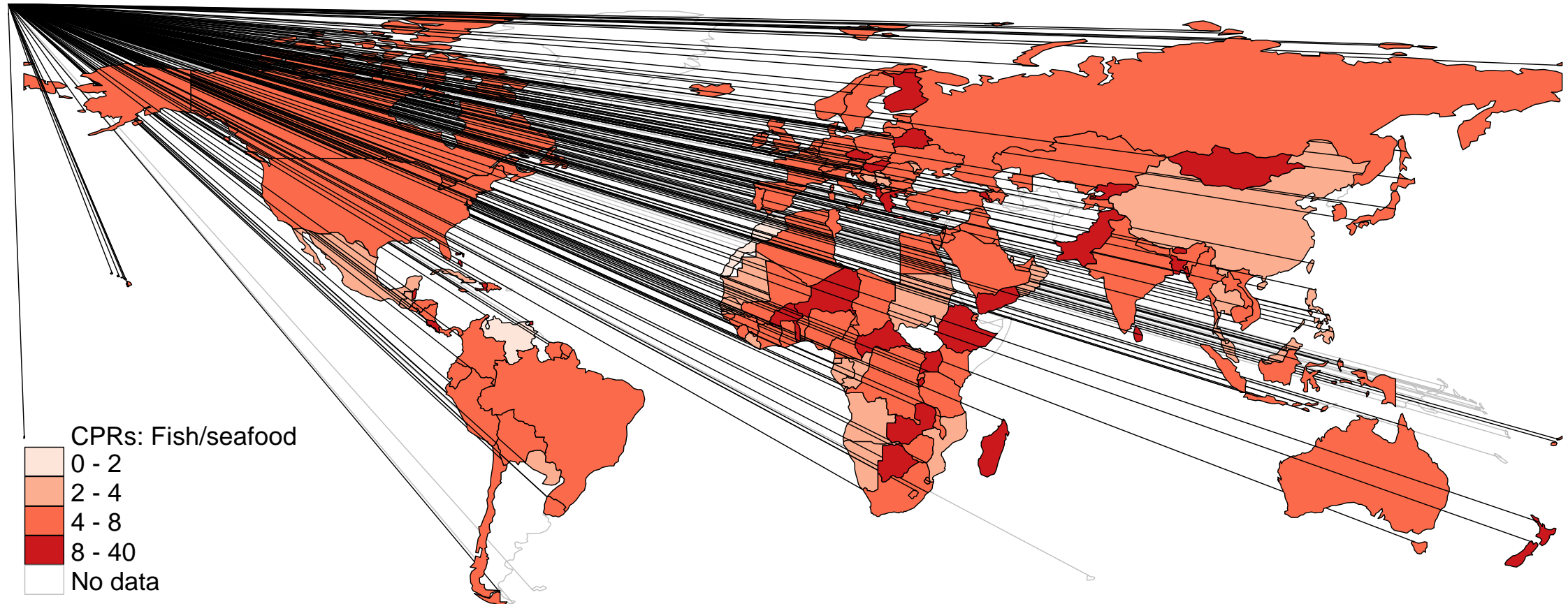


#### **Relative caloric prices of ASFs vary across incomes levels and regions:**

- *Generally cheap in middle and upper income countries*
- *Dairy cheap in South Asia and East Asia*
- *Dairy & eggs expensive in Africa and SE Asia, but fish is cheap*

	Milk	Eggs	White meat	Red meat	Fish
Europe (N=39)	2.11	3.42	4.09	3.38	5.84
North America & Australasia (N=6)	1.48	1.72	1.85	2.00	6.47
Latin America & Caribbean (N=38)	2.32	3.25	2.76	2.95	5.41
Middle East & North Africa (N=18)	4.28	5.35	5.06	5.09	5.31
Central Asia (N=6)	3.80	4.67	4.47	3.58	8.28
China (N=1)	2.46	4.69	3.64	1.97	3.47
Other East Asia (N=5)	2.57	2.24	6.17	4.82	4.52
South-East Asia (N=10)	6.63	8.18	5.74	3.82	4.89
India (N=1)	2.77	5.32	7.09	2.27	6.98
Other South Asia (N=6)	3.95	5.75	6.99	4.74	10.14
Eastern & Southern Africa (N=19)	8.96	8.97	9.33	3.10	10.13
Western & Central Africa (N=27)	9.94	12.87	9.29	3.76	6.58

# 3. How does ASF affordability vary across the world?



# 4. Does ASF affordability explain ASF consumption?



**Simple demand models show that differences in relative ASF prices explain cross-country differences in consumption**

	Dairy	Eggs	Fish	Meat
<b>Own price (RCP), log</b>	<b>-0.09*</b> (-0.17,-0.01)	<b>-0.12***</b> (-0.17,-0.06)	<b>-0.15***</b> (-0.24,-0.07)	<b>-0.10#</b> (-0.21,0.00)
<b>GDP per capita, log</b>	<b>0.21***</b> (0.16,0.26)	<b>0.09***</b> (0.06,0.13)	<b>-0.08**</b> (-0.13,-0.03)	<b>0.13***</b> (0.09,0.18)
<b>Mean consumption</b>	41.5%		26.6%	
<b>Mean CPR</b>	7.2		7.1	
<b>N (countries)</b>	56	56	55	56

Price differences explain ~20% of difference between high & low dairy countries

Income effects always positive, except for fish ("inferior good")

# Do ASF prices explain stunting differences?



- Use WHO stunting data to look at ASF prices & stunting across ~100 countries
- Adjust for GDP p.c., urbanization, education, women's empowerment, sanitation

	Milk RCP, logged	Egg RCP, logged	Meat/fish RCP, logged	Infant cereal RCP, logged
<u>Unadjusted model</u>	12.53*** (9.68,15.38)	11.60*** (8.21,14.98)	9.70** (3.64,15.75)	11.36*** (8.33,14.39)
R <sup>2</sup>	0.44	0.33	0.10	0.38
N (countries)	101	101	101	95
<u>Adjusted model</u>	4.79*** (2.02,7.56)	3.34* (0.42,6.26)	0.48 (-3.52,4.49)	3.14* (0.28,5.99)
	0.75	0.72	0.70	0.72
	101	101	101	94

Dairy results are easily the **most robust** to alternative dependent variables & specifications

# What can be done to improve ASF affordability?



- **Many nutrition-sensitive agricultural interventions are limited in scope and scale:**
  - Focused on producers (e.g. EHFP programs)
  - Often assume high degree of own-consumption, but the poor use markets
  - No focus on reducing economywide prices
- **Economywide success stories deserve more attention**
  - Focus on consumers and producers (rural-urban linkages, value chains)
  - Sometimes involve smallholders (e.g. dairy), sometimes not (e.g. poultry)
  - Often programs had limited nutritional objectives (profitability incentives)
  - But successful programs should reduce prices, increase access, improve safety



# What can be done to improve ASF affordability?

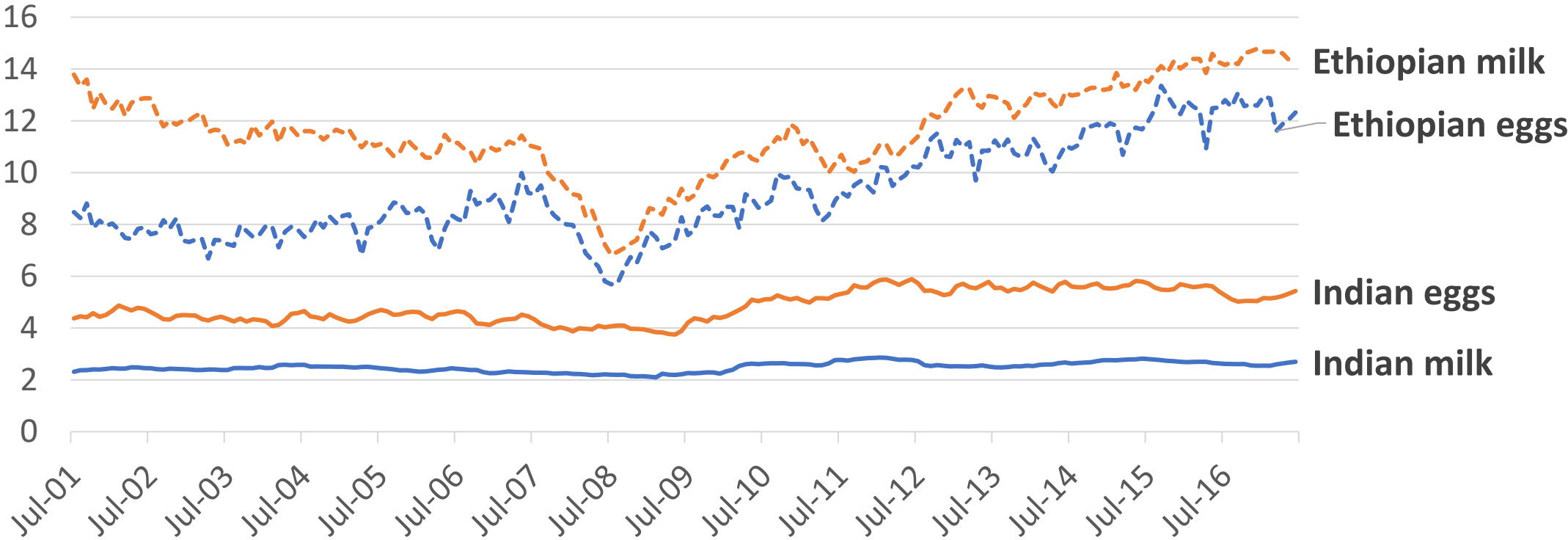


- **For highly perishable commodities, we would expect prices to be heavily determined by domestic supply, or productivity**
- **Some countries have seen major successes in ASFs, notably India:**
  - Operation Flood from 1970s onwards: smallholder dairy collectives connected to urban markets
  - Commercial (largeholder) poultry production from 1990s onwards
- **Other countries are seeing rapid productivity growth in staples, but struggling to achieve growth in ASFs, notably Ethiopia**
  - 4-6% growth per annum in cereals
  - Rising prices of ASFs



# What can be done to improve ASF affordability?

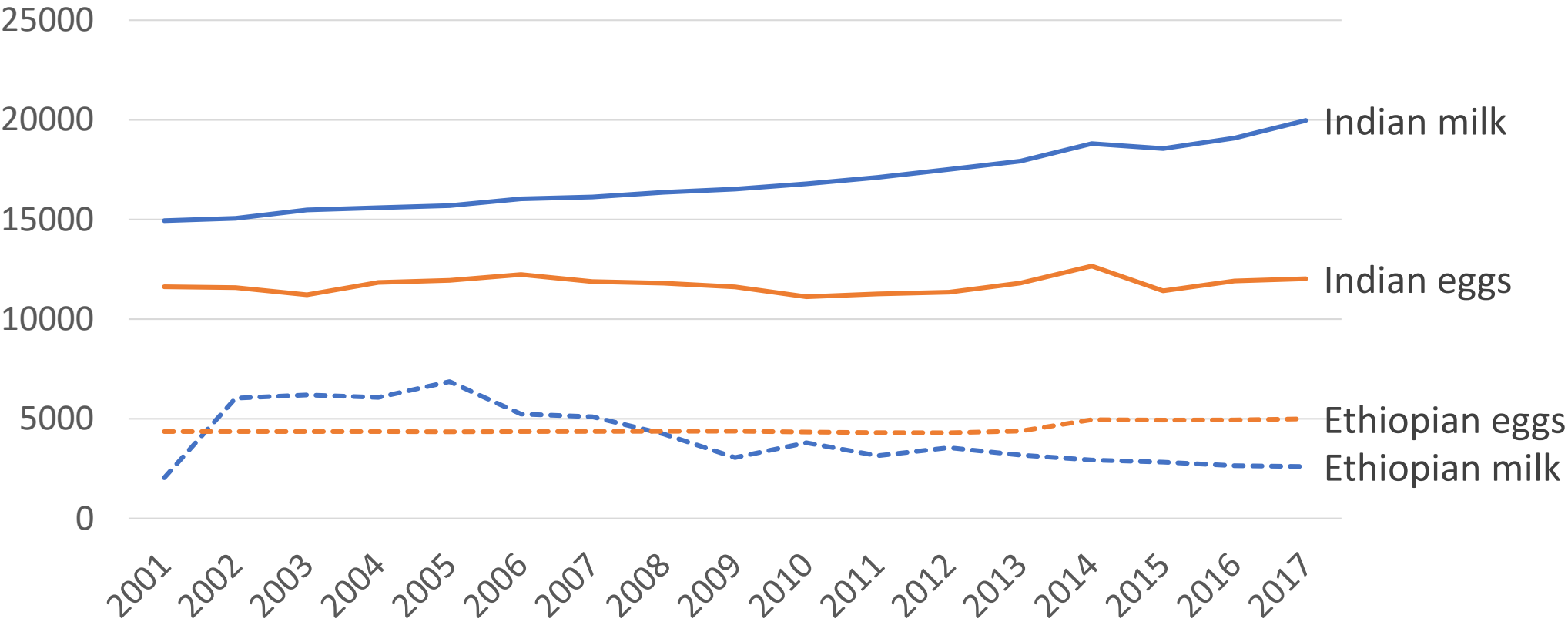
### Trends in relative caloric prices in Ethiopia & India, 2001-2017





# What can be done to improve ASF affordability?

### Trends in yields for milk and egg layers, 2001-2017





# What can be done to improve ASF affordability?

- **ASF price differences across countries largely stem from productivity differences** (and in some cases irrational trade policies)
- **Different ASF sectors have different constraints and require different institutional arrangements** (e.g. smallholders vs largeholders)
- **In Africa high feed costs are a major constraint**, particularly for poultry production, perhaps aquaculture too
- **Connection to markets also problematic:**
  - Urbanization typically a big driver of commercialization
  - Multiple value chain bottlenecks: roads, electricity, institutional issues

# A little caveat



**Supple-side constraints are clearly very important, but...**

- **Large-scale evidence on nutritional knowledge is missing (mostly qual)**
- **Knowledge/culture clearly very important:**
  - ASFs cheap in India, but non-dairy ASF consumption low among both vegetarian and non-vegetarian populations
  - Seasonality in ASF prices in Ethiopia associated with religious festivals
- **Figuring out how to combine supply-side and demand-side interventions to maximum effect is *the* key challenge**

# In summary



1. **ASF consumption patterns vary across the developing world**, and in surprising ways (e.g. dairy vs fish)
2. **ASF consumption patterns strongly associated with child stunting** (especially dairy)
3. **ASFs are generally very expensive in developing countries**, although fish and dairy products cheap in *some* LDCs
4. **ASF prices are strongly associated with child ASF consumption patterns**
5. **ASF prices – especially dairy - strongly associated with stunting**
6. **Reducing ASF prices should be a critical priority for nutrition-sensitive agricultural development strategies: learn from at-scale success stories!**





- Thank you

[d.headey@cgiar.org](mailto:d.headey@cgiar.org)