

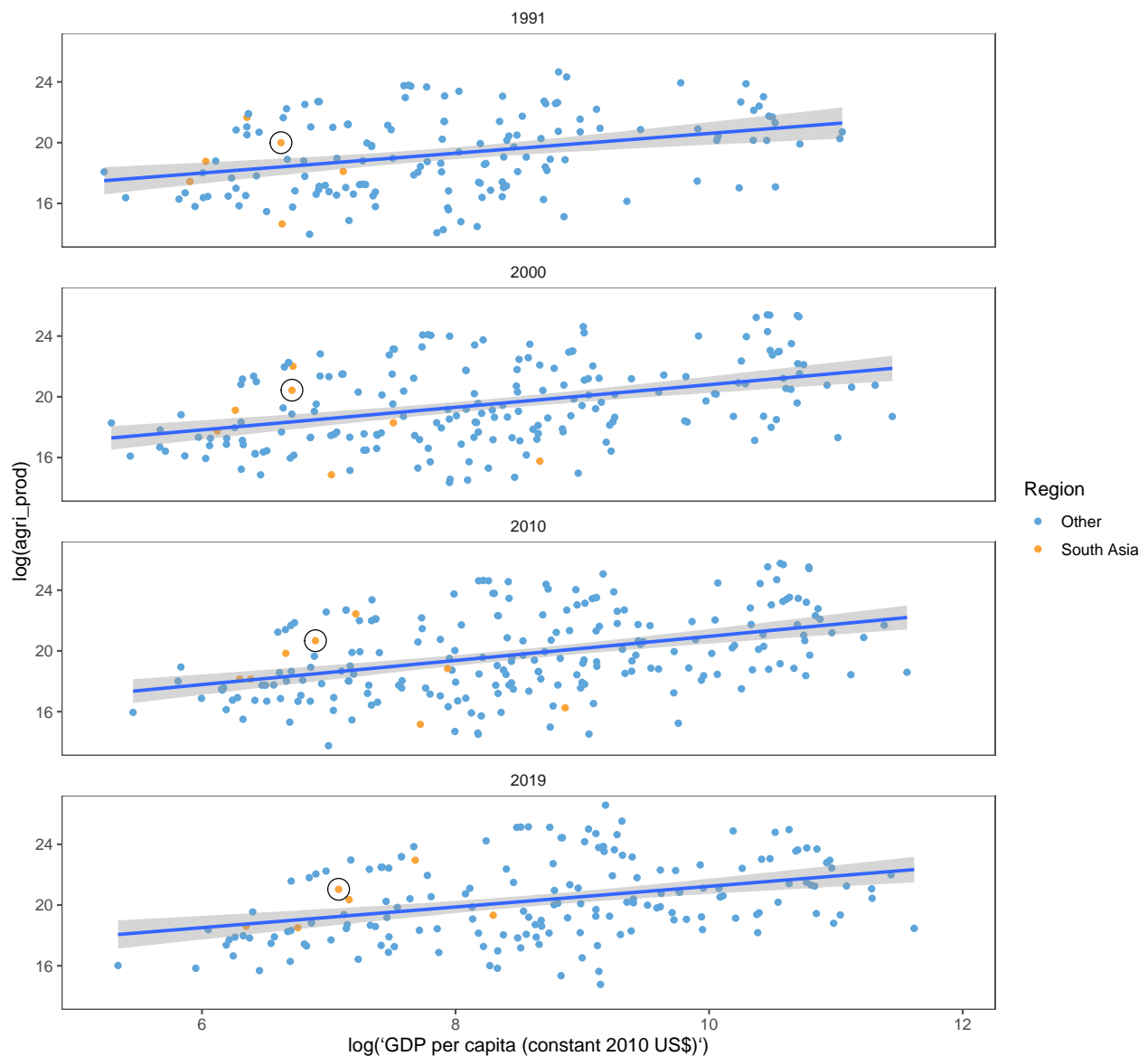
# Agriculture in Pakistan

## Does Pakistan have low Agri Productivity?

How does Pakistan compare to other countries in terms of labor and land productivity, as a whole? At first look, no. For its level of GDP per capita, it is above what is expected for its labor productivity. What we could do is run a regression through which we can control for things like 'land quality'? Anyways.

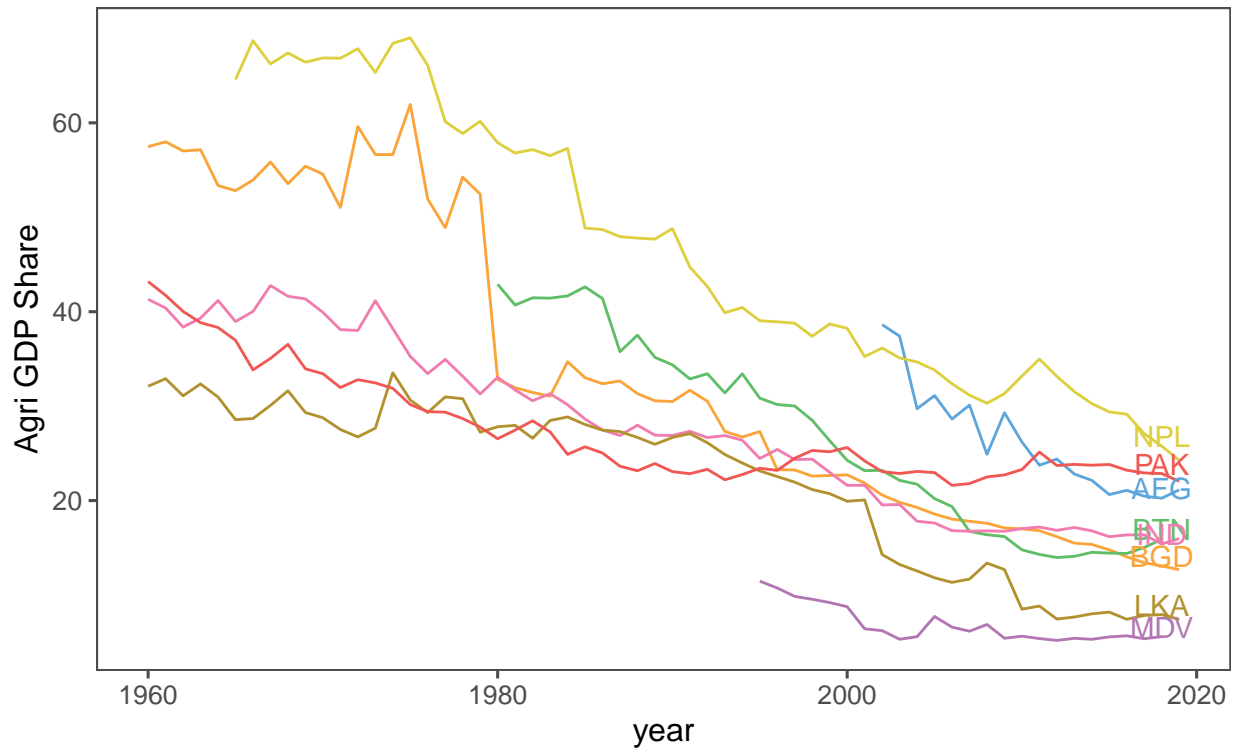
### Comparing Labor Productivity in Agriculture

Pakistan circled



Agri productivity is not lower than expected in Pakistan. However, it is the slowest to transition away from agriculture in all of South Asia. The only country with more reliance on Agriculture is Nepal, and Nepal is rapidly shifting away.

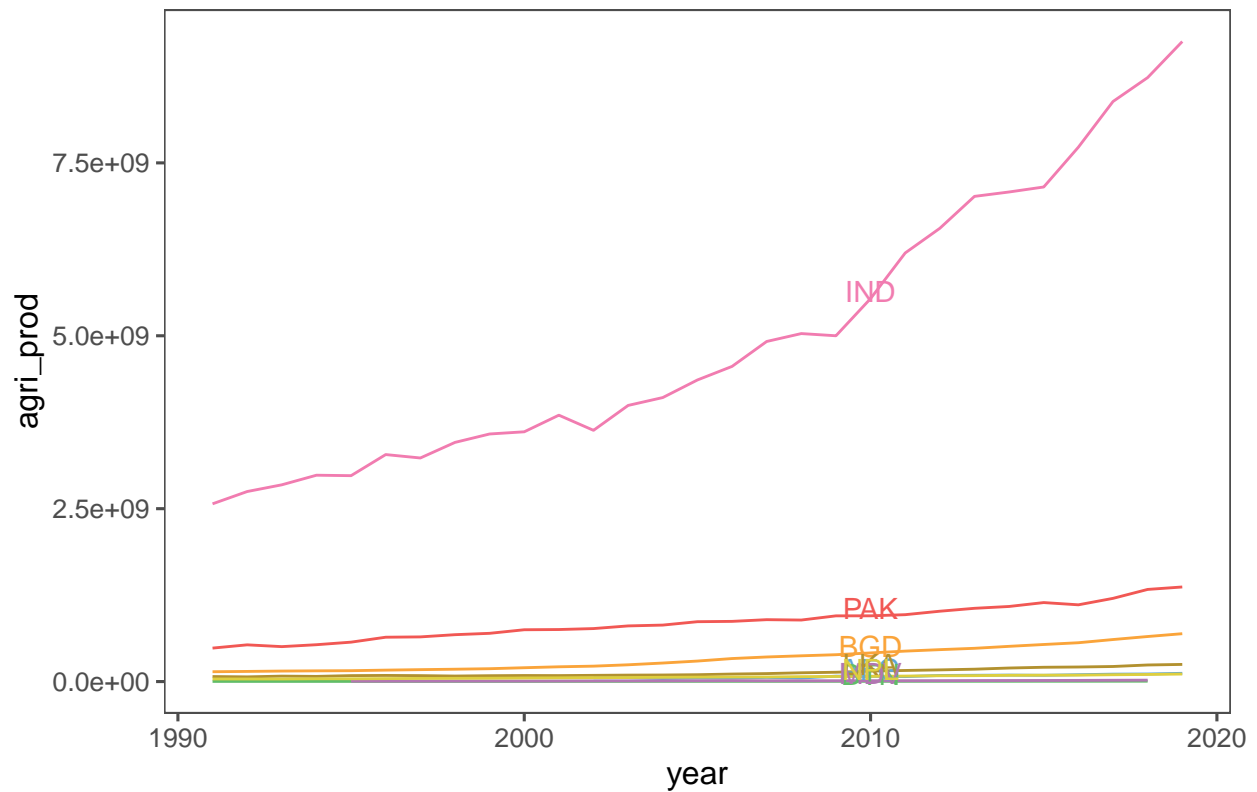
### South Asian reliance on Agriculture over time



Source: World Bank

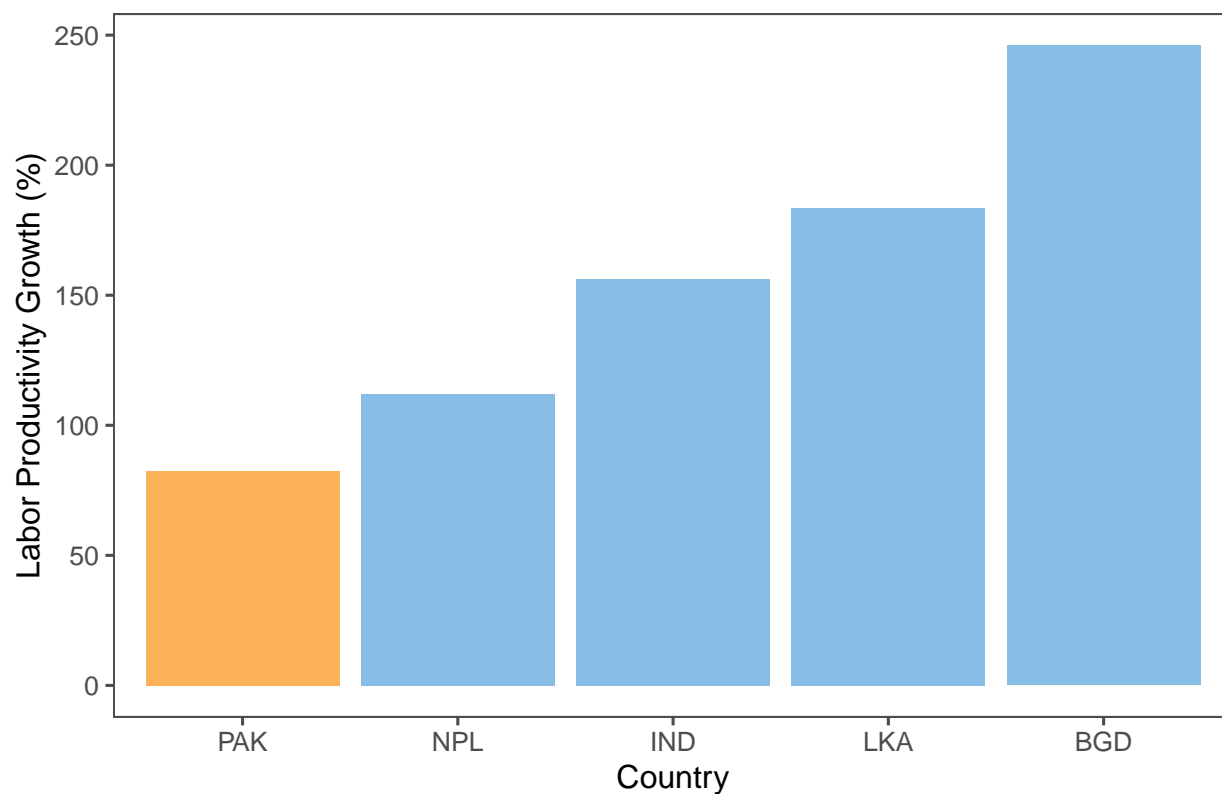
As time goes on, how does Pakistans agri productivity improve relative to others? The gap between Pakistan and India has widened considerably, but it is in line with improvements to Agri Productivity in other South Asian countries.

## South Asian Agri Labor Productivities over Time



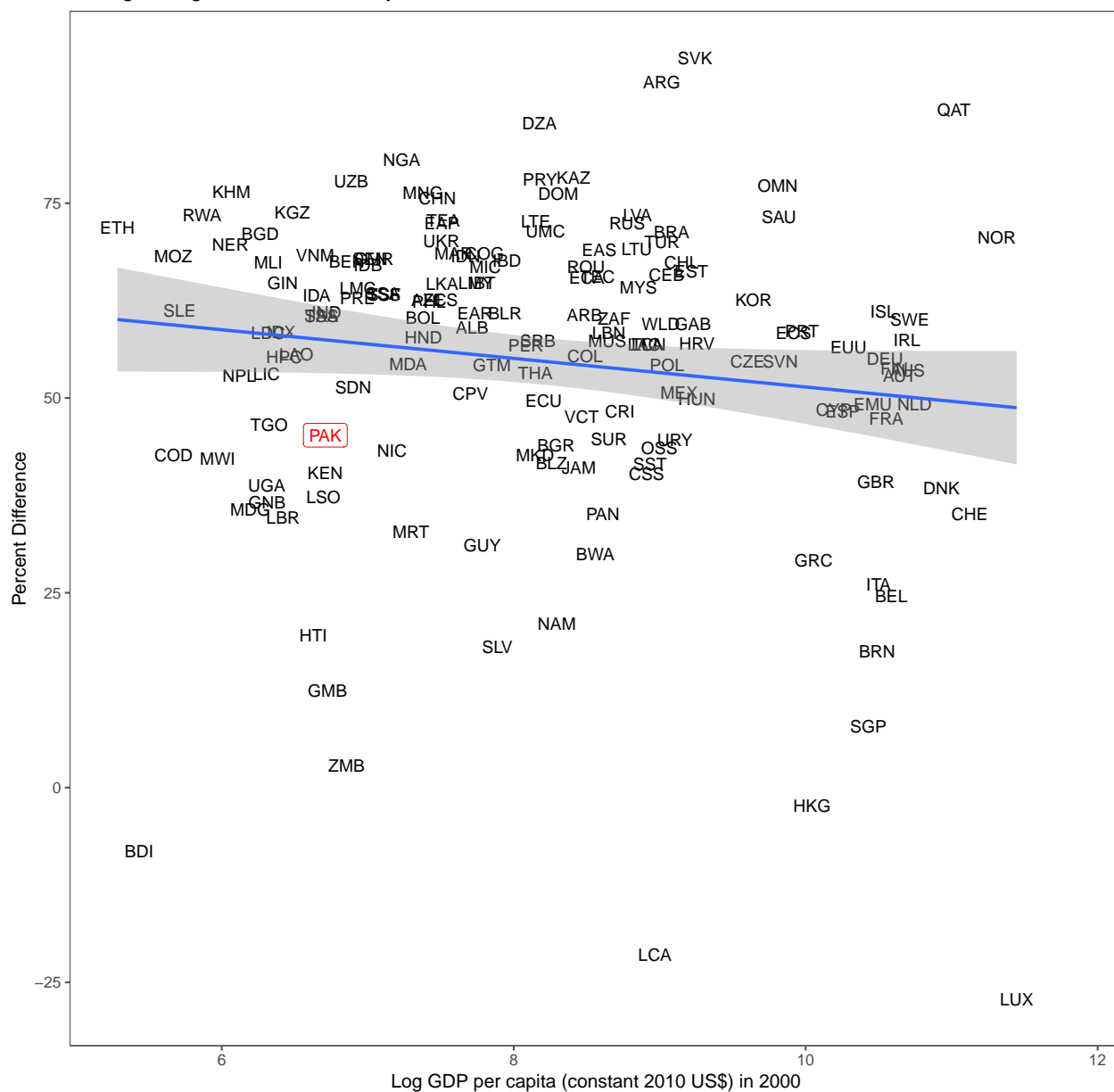
We can easily compare growth rates in agri labor prod in the last decade and see where Pakistan stands. Since 1991, it has had the slowest rate of labor productivity growth in all of South Asia. This is also true when we look at the growth between 2010 and 2019 - it is tied with Nepal. Here we chart 2000 and 2019.

South Asian Agri Labor Productivity growth between 2000 and 2019



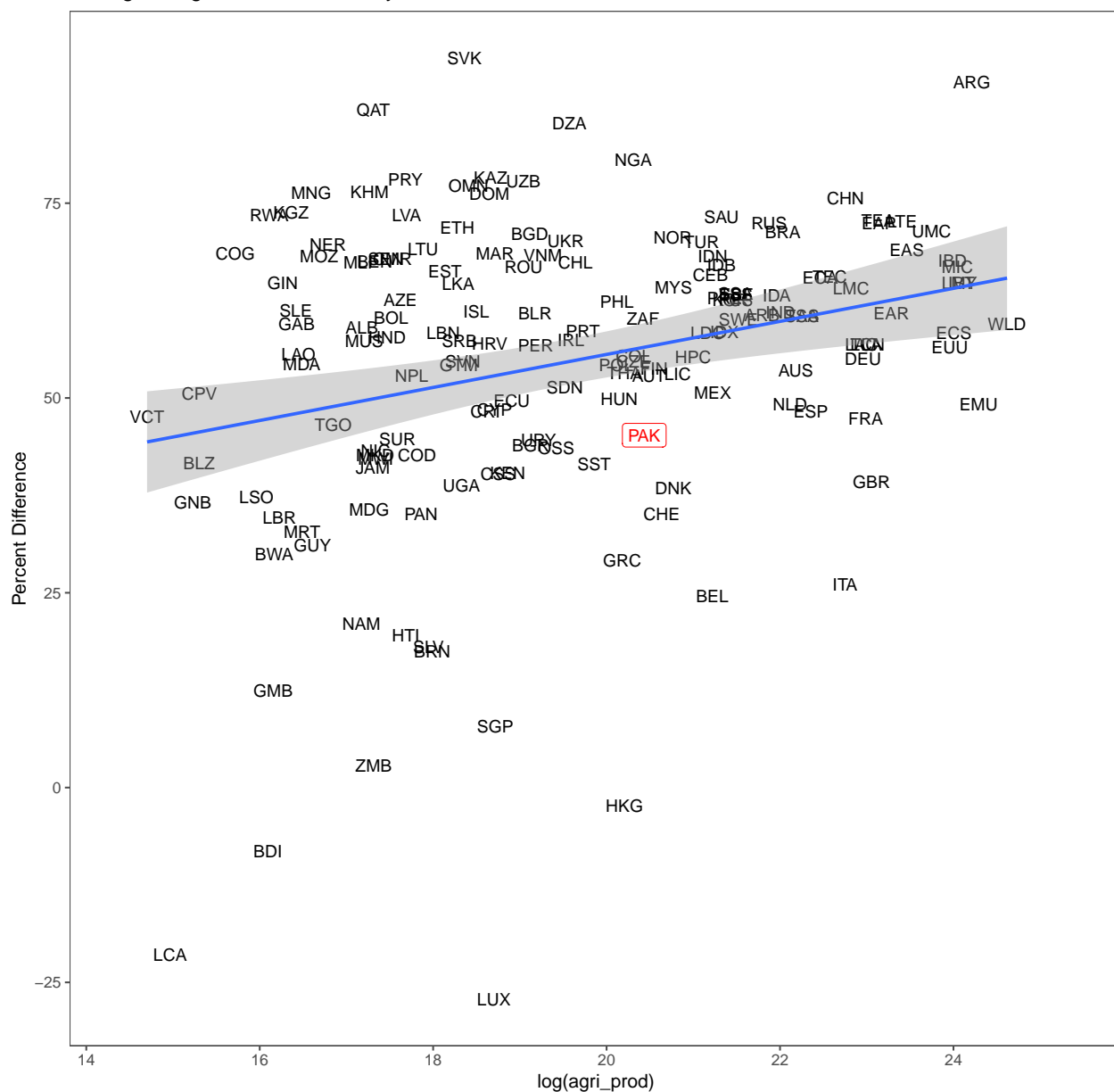
Given its level of GDP per capita in 2000, Pakistan has underperformed in Agri productivity growth compared to the world.

Change in Agri Labor Productivity between 2000 and 2019



This remains true even if we compare for its initial level of agri productivity in 2000.

Change in Agri Labor Productivity between 2000 and 2019



So the story seems to be - Pakistan was endowed with a high labor productivity in Agriculture coming into the 90s, but was unable to grow it significantly since then. Labor could not be absorbed into more services work, and industry productivity fell.

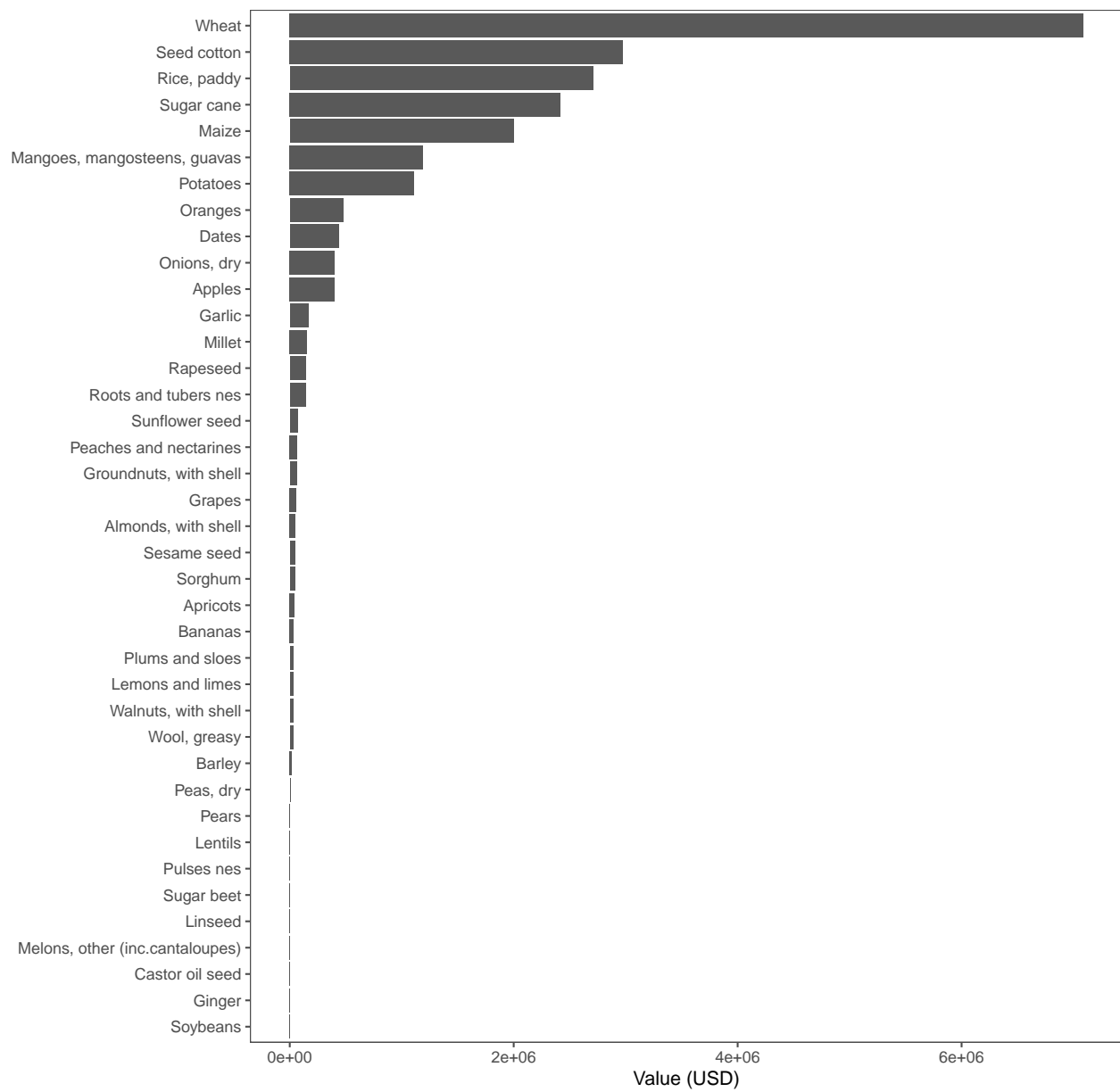
Next - I want to develop a comparison group for Pakistan based on the land shares allocated to the largest crops. So far we are looking just at South Asia, and countries in its GDP per capita neighbourhood.

## Overview

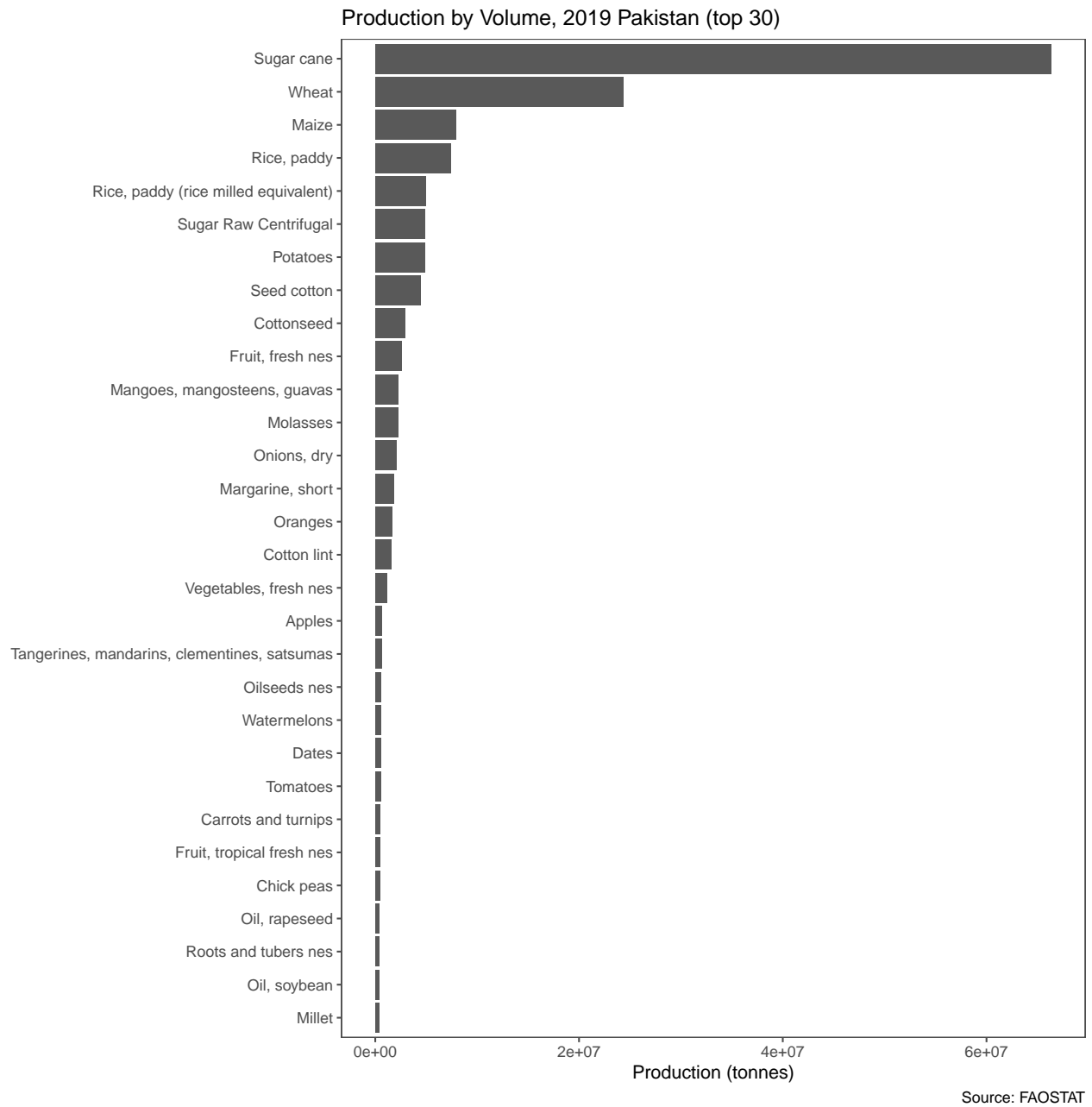
The approach I want to take is to start by looking at productivity spreads per crop. Some active questions - what is Pakistan producing, how good is it at doing this, how is it changing over time?

First question - what does Pakistan produce? I took 2019 because it is recent and pre-covid.

Gross Production Value, 2019 Pakistan

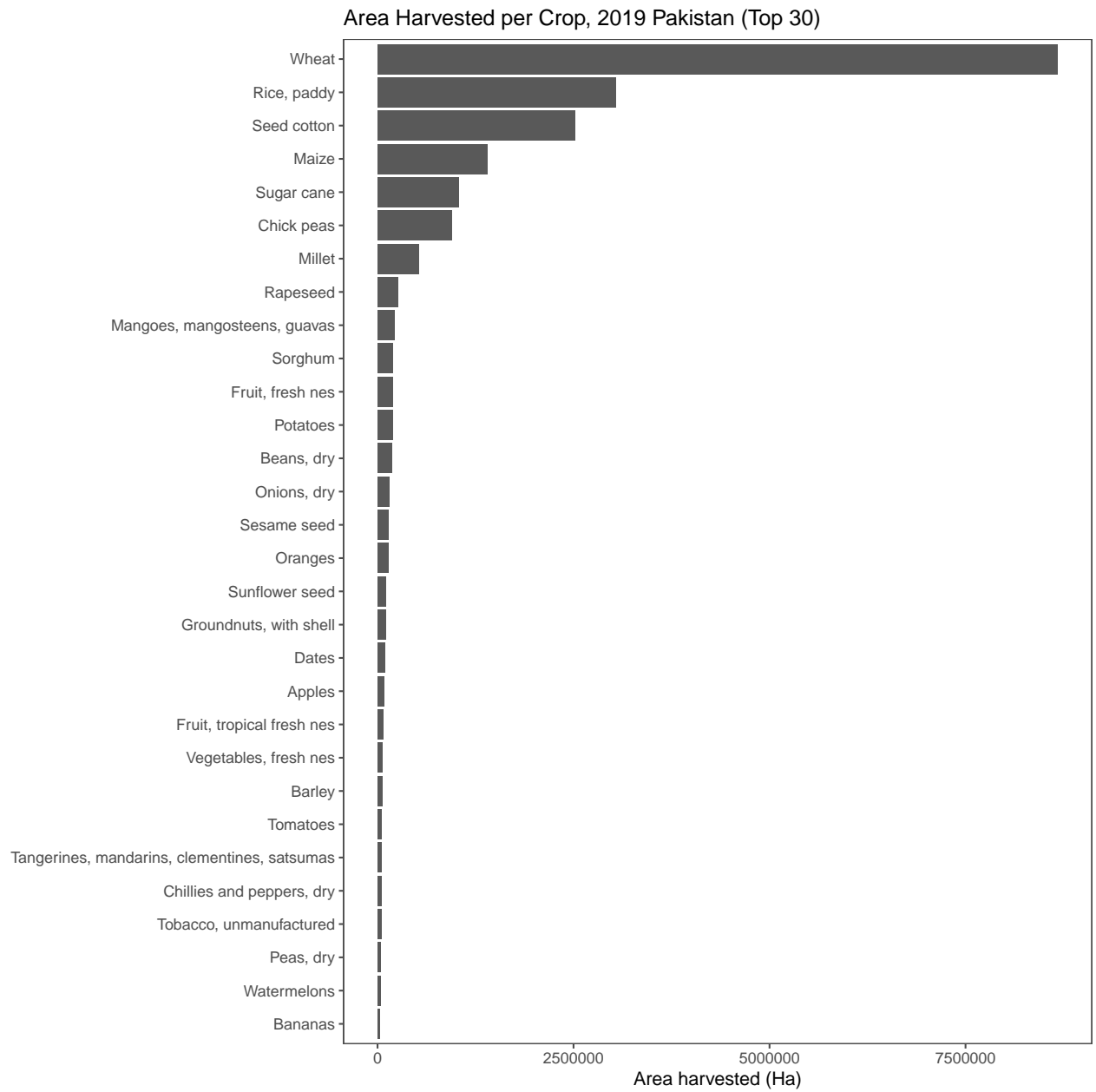


Source: FAOSTAT



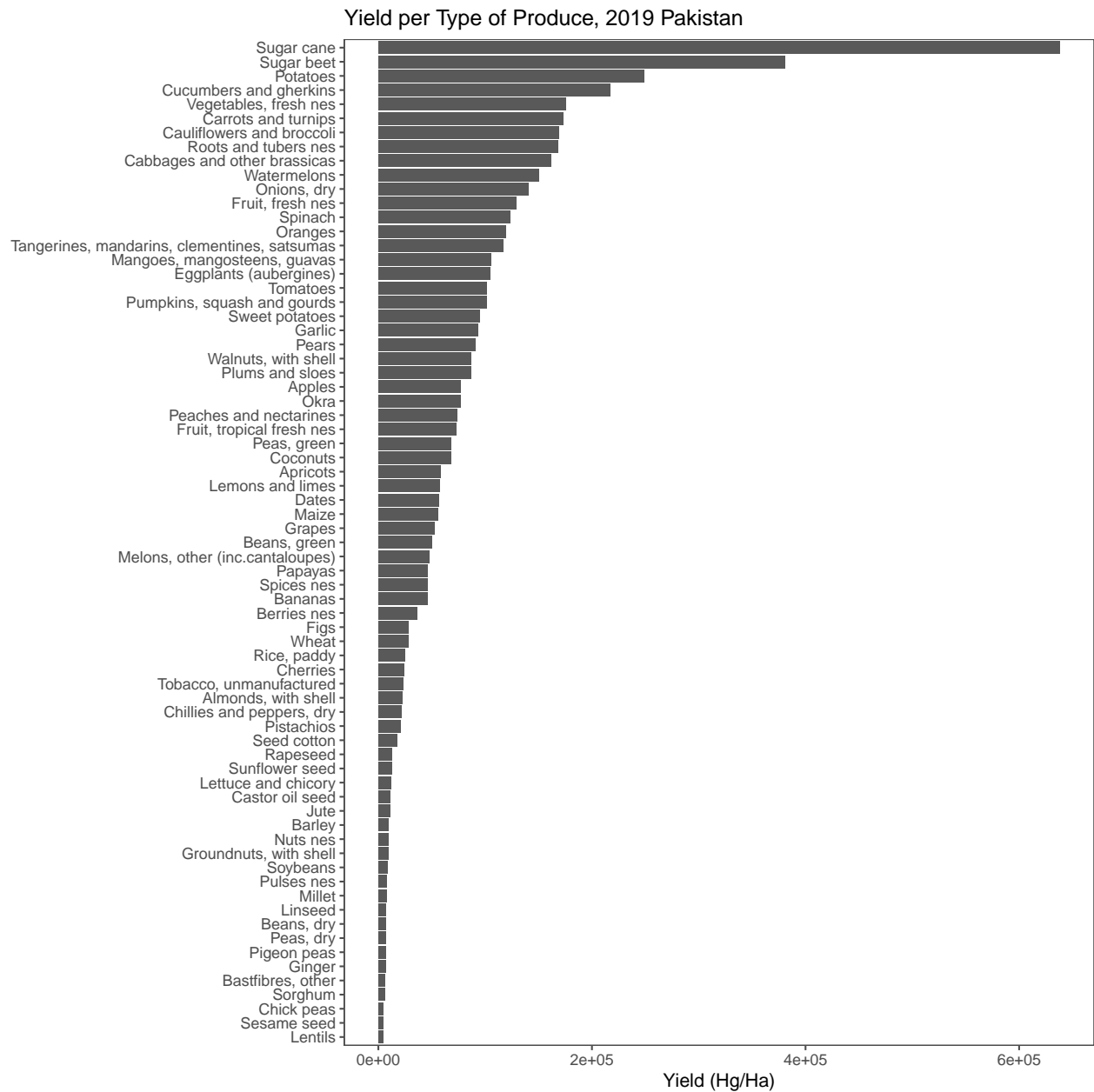
Lets look at how much land is allocated to each crop.





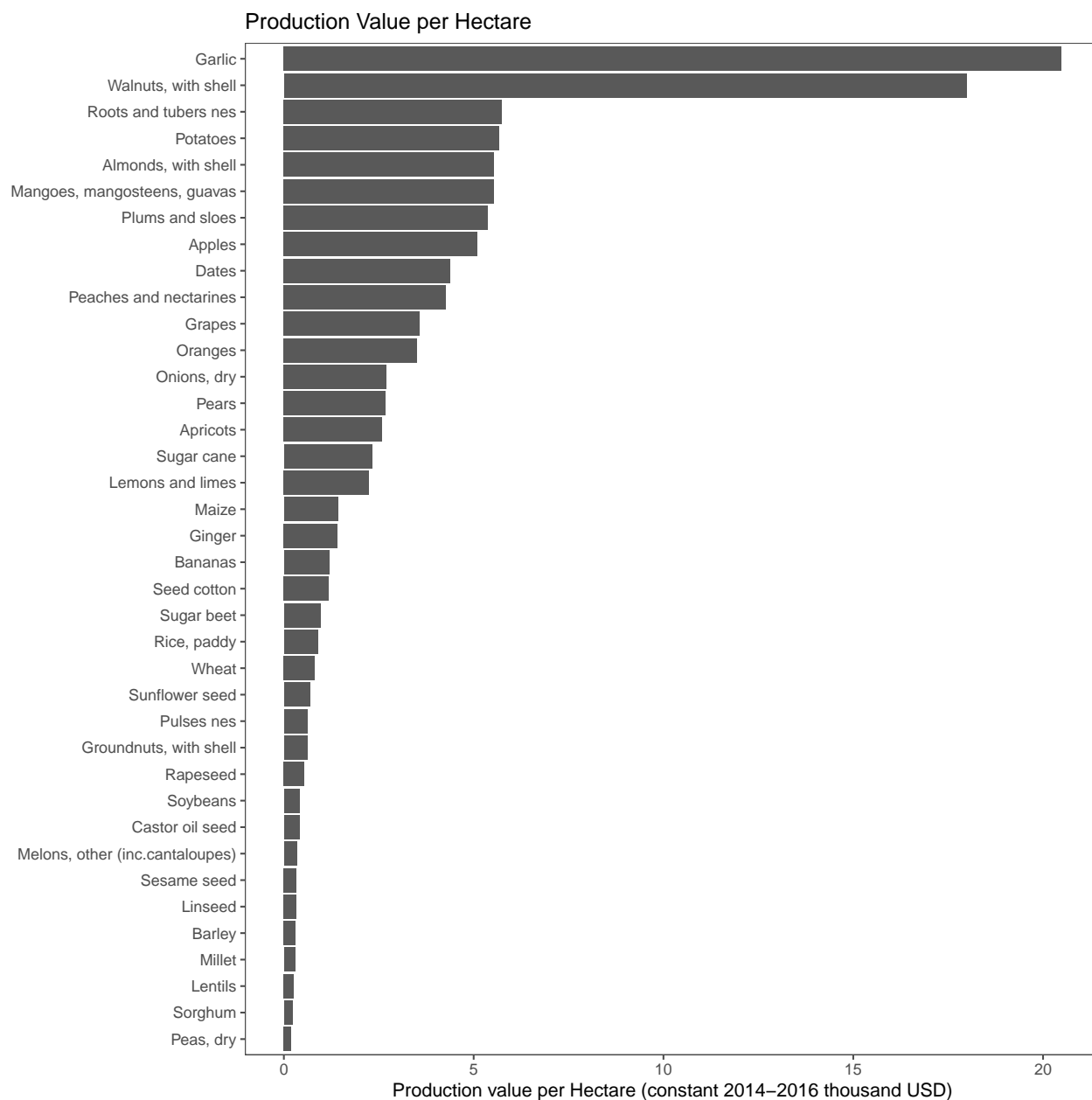
Source: FAOSTAT

Combining these, we can get yields per produce item. This tells us how much of the item is produced on a given piece of land.



Other information which would be nice to know are the prices for each of these items. Ultimately we want to get at most efficient dollar per amount of effort, so labor information is also good to have.

Lets see what happens if we think about combining indicators. We have the area under cultivation, which is some sort of measure for how many people are doing it (crude). We have the gross production value, which tells us about the prices. Production value per area harvested is then an interesting metric that tells us about yield in an economic sense.



Another approach is to compare yields of the crops produced against others in the region, or global averages. Who would be good to compare to? This should be the next approach. Is there an area where Pakistan actually has higher or comparable efficiency to another place?

Table 1: Top 50 Crops by Yield Rank

item	Avg Yield	Yield / Avg Yield	Yield Rank	Volume Rank	Pak Yield	Pak Value	Pak Export
Walnuts, with shell	37533	2.32	5	19	87043	19475	-11021
Roots and tubers nes	98468	1.71	9	4	168215	91378	NA
Fruit, fresh nes	80368	1.61	23	4	129262	NA	-17100
Pistachios	14468	1.42	6	14	20511	NA	-3949
Vegetables, fresh nes	128944	1.36	45	19	175411	NA	22973

item	Avg Yield	Yield / Avg Yield	Yield Rank	Volume Rank	Pak Yield	Pak Value	Pak Export
Peas, green	54501	1.25	24	7	68049	NA	627
Potatoes	209699	1.19	52	19	248874	973017	110648
Castor oil seed	9532	1.18	9	21	11250	326	NA
Tobacco, unmanufactured	19813	1.17	29	11	23254	NA	-13717
Coconuts	58736	1.16	29	56	67928	NA	-4390
Maize	50012	1.12	57	19	56141	1966734	-22487
Sugar cane	576770	1.11	43	6	638407	2079075	NA
Cauliflowers and broccoli	159836	1.06	39	12	168945	NA	1081
Seed cotton	17470	1.02	36	6	17798	2640106	NA
Mangoes, mangosteens, guavas	104160	1.01	39	6	105690	1034549	NA
Garlic	94551	0.98	41	22	92912	133191	-56780
Plums and sloes	93448	0.93	34	27	86673	22473	107
Fruit, tropical fresh nes	81310	0.90	34	12	72955	NA	NA
Spinach	144580	0.85	38	9	123586	NA	NA
Wheat	33956	0.83	64	9	28059	6208136	NA
Apricots	71582	0.82	38	11	58361	29239	-12932
Almonds, with shell	27437	0.81	14	20	22228	30597	-104
Oranges	147282	0.81	58	14	118997	295021	2045
Spices nes	56552	0.81	17	8	45687	NA	69930
Sweet potatoes	119070	0.79	55	65	94568	NA	NA
Sunflower seed	17072	0.75	46	25	12814	62397	-4522
Sugar beet	512688	0.74	41	42	380868	834	NA
Tangerines, mandarins, clementines, satsumas	157147	0.74	42	12	116466	NA	NA
Peaches and nectarines	104760	0.70	49	23	73652	39636	NA
Dates	86492	0.66	21	6	56794	288130	62880
Okra	122456	0.63	23	6	76839	NA	NA
Pears	145222	0.62	49	49	90721	2746	122
Cabbages and other brassicas	263489	0.61	110	55	161817	NA	5817
Beans, green	82822	0.61	64	54	50268	NA	NA
Onions, dry	231713	0.61	97	7	140255	338383	51654
Carrots and turnips	287206	0.60	84	17	172825	NA	55
Rice, paddy	40668	0.60	89	15	24436	1112938	-32046
Chillies and peppers, dry	36656	0.59	34	10	21470	NA	2637
Sesame seed	7915	0.58	55	17	4620	40544	40326
Rapeseed	22818	0.57	52	24	12969	114545	NA
Berries nes	64038	0.57	36	30	36227	NA	NA
Pumpkins, squash and gourds	185126	0.55	88	20	100995	NA	NA
Watermelons	277627	0.54	90	22	149887	NA	-389
Grapes	99063	0.53	74	55	52383	35425	NA
Pulses nes	14720	0.53	87	71	7732	1937	NA
Millet	14864	0.50	62	14	7361	109743	-2318
Soybeans	18430	0.48	85	98	8824	6	-754878
Apples	167359	0.46	66	25	77133	230459	-43196
Beans, dry	15401	0.46	82	36	7088	NA	NA
Pigeon peas	14644	0.46	21	24	6667	NA	NA

It turns out we are very good at producing pistachios and also walnuts. We need to compare this also to the productivity levels of net exporters to see potential size of opportunity.

Actually we need to get relative volumes produced as well and use this in the comparison. Maybe need to

relativize it based on per capita, land use, etc.

Below we look at a similar table, but sorted by how much we produce and then how well we produce it next to it. We can see that we produce the 3rd most chick peas in the entire world, but are the 42nd most productive in doing it. I know that people produce chick peas when they don't have access to water. It is also the 6th largest crop based on the area it takes up.

Table 2: Top 20 Crops Produced by Volume (World Ranking), 2019

Item	World Rank (Tonnes Produced)	World Rank (Yield)	Yield / Avg Yield	Net Export
Fruit, fresh nes	4	23	1.61	-17100
Roots and tubers nes	4	9	1.71	NA
Chick peas	5	42	0.30	NA
Dates	6	21	0.66	62880
Mangoes, mangosteens, guavas	6	39	1.01	NA
Okra	6	23	0.63	NA
Seed cotton	6	36	1.02	NA
Sugar cane	6	43	1.11	NA
Onions, dry	7	97	0.61	51654
Peas, green	7	24	1.25	627
Spices nes	8	17	0.81	69930
Spinach	9	38	0.85	NA
Wheat	9	64	0.83	NA
Chillies and peppers, dry	10	34	0.59	2637
Apricots	11	38	0.82	-12932
Tobacco, unmanufactured	11	29	1.17	-13717
Cauliflowers and broccoli	12	39	1.06	1081
Fruit, tropical fresh nes	12	34	0.90	NA
Tangerines, mandarins, clementines, satsumas	12	42	0.74	NA
Millet	14	62	0.50	-2318

Table 3: Crops Produced with Higher Yield than World Average, 2019

item	rel_yield	vol_rating	pak_export
Walnuts, with shell	2.32	19	-11021
Roots and tubers nes	1.71	4	NA
Fruit, fresh nes	1.61	4	-17100
Pistachios	1.42	14	-3949
Vegetables, fresh nes	1.36	19	22973
Peas, green	1.25	7	627
Potatoes	1.19	19	110648
Castor oil seed	1.18	21	NA
Tobacco, unmanufactured	1.17	11	-13717
Coconuts	1.16	56	-4390
Maize	1.12	19	-22487
Sugar cane	1.11	6	NA
Cauliflowers and broccoli	1.06	12	1081
Seed cotton	1.02	6	NA
Mangoes, mangosteens, guavas	1.01	6	NA

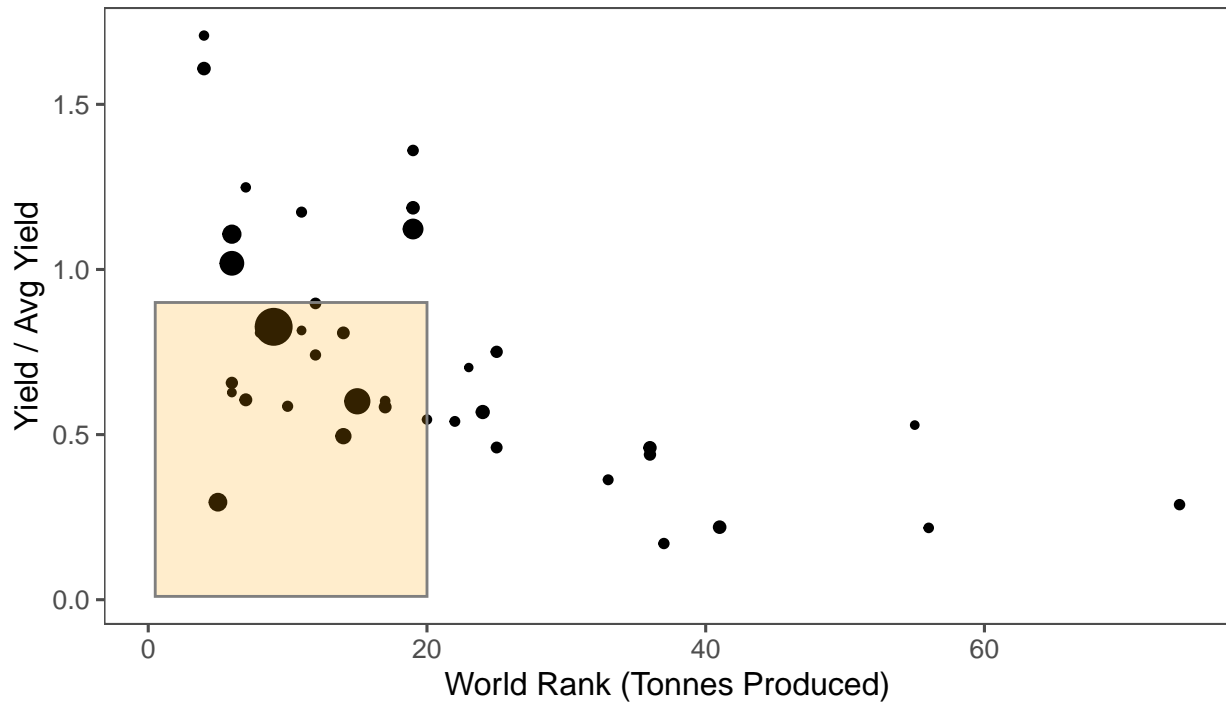
On the volume side, the amount of land dedicated to it as a proportion of total land that is being used is an interesting indicator.

I think I am getting interested in crops we dedicate a lot of land / produce a lot of, but we do poorly. And then we can focus on why it is done poorly and what could be done about it.

Such crops would be ones with very low Yield / avg yield in the world, and a very large world rank in terms of tonnes produced. Below we look at those products, given that the area harvested is above some minimum threshold.

## Relative Yield vs Amount Produced, Pakistan 2019

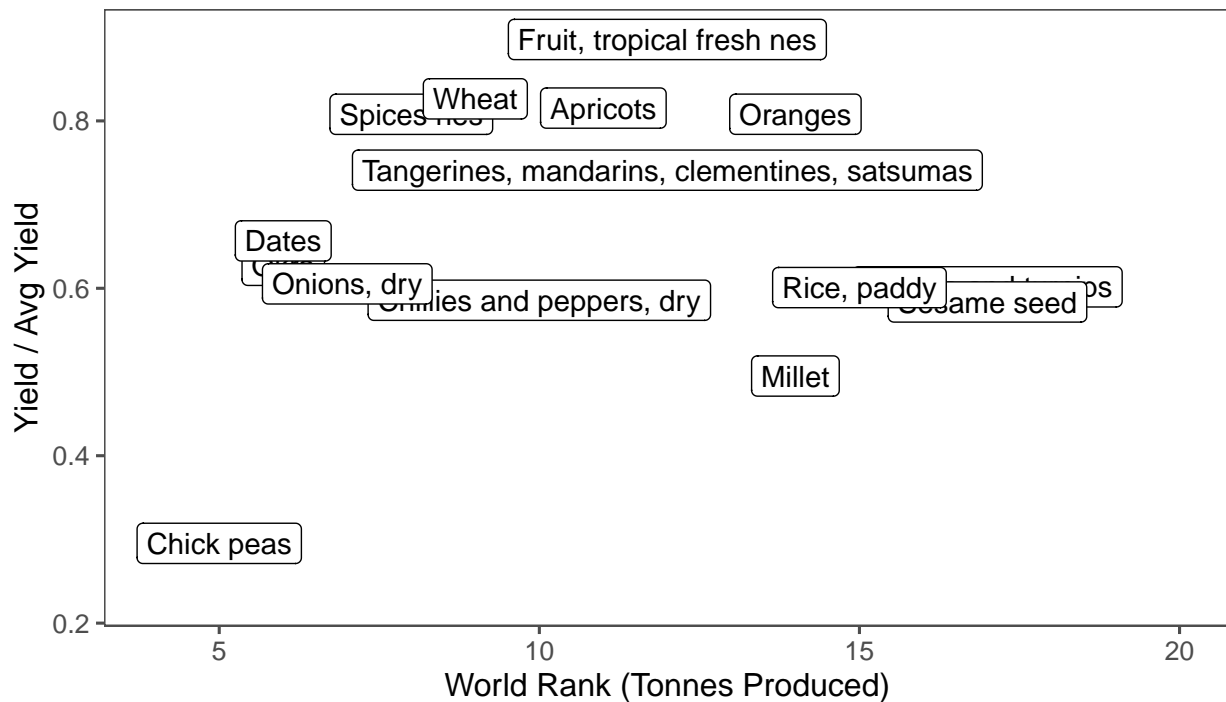
Point size indicates area harvested



Source: FAOSTAT

## Relative Yield vs Amount Produced, Pakistan 2019

Zoom of Highlighted Box above

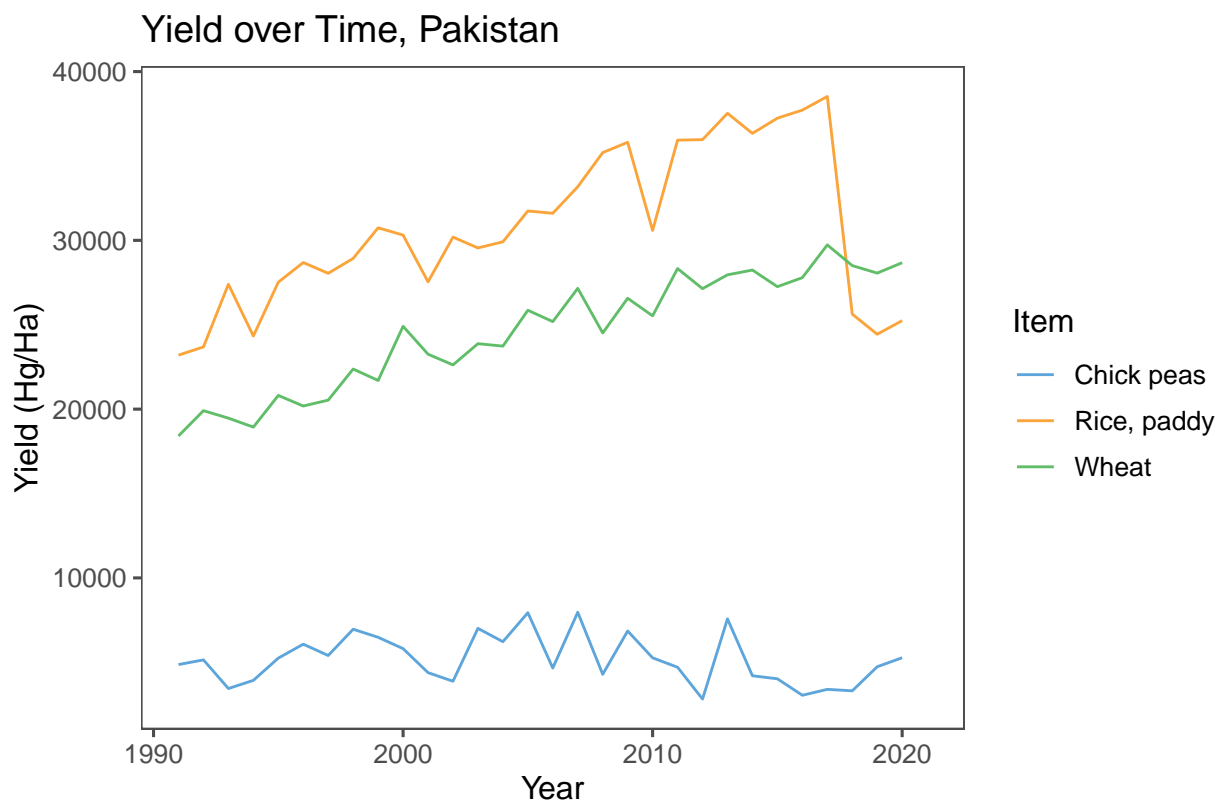


Source: FAOSTAT

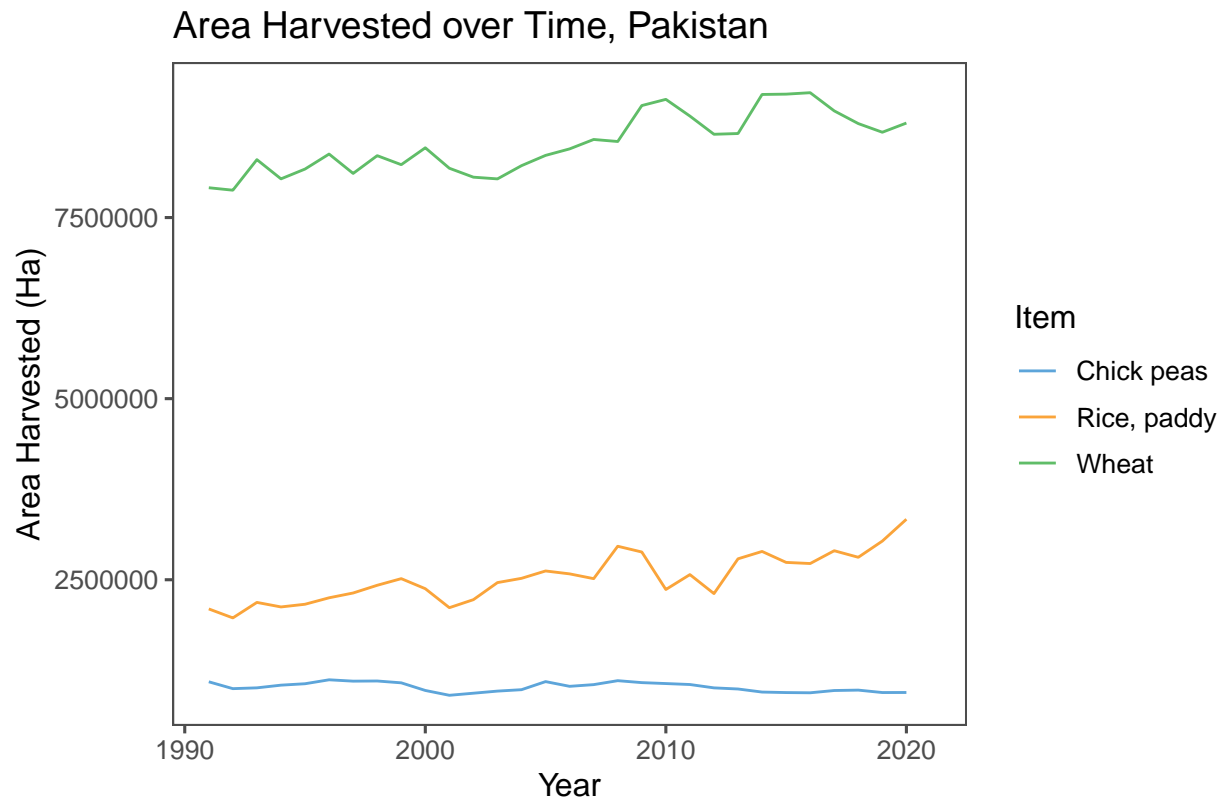
Table 4: Products within highlighted box

Item	Index	World Rank (Tonnes Produced)	World Rank (Yield)	Yield / Avg Yield	Area Harvested
Wheat	7.44	9	64	0.83	8677730
Rice, paddy	9.01	15	89	0.60	3033909
Chick peas	1.48	5	42	0.30	943058
Millet	6.93	14	62	0.50	522187
Onions, dry	4.24	7	97	0.61	148272
Sesame seed	9.92	17	55	0.58	139514
Oranges	11.31	14	58	0.81	135683
Dates	3.94	6	21	0.66	99466
Fruit, tropical fresh nes	10.77	12	34	0.90	66852
Tangerines, mandarins, clementines, satsumas	8.89	12	42	0.74	51232
Chillies and peppers, dry	5.86	10	34	0.59	47349
Carrots and turnips	10.23	17	84	0.60	29187
Spices nes	6.46	8	17	0.81	16653
Okra	3.76	6	23	0.63	16239
Apricots	8.97	11	38	0.82	16177

Lets focus on the top 3 items from this list - Wheat, Rice paddy and Chick peas. How have these products changed over time?



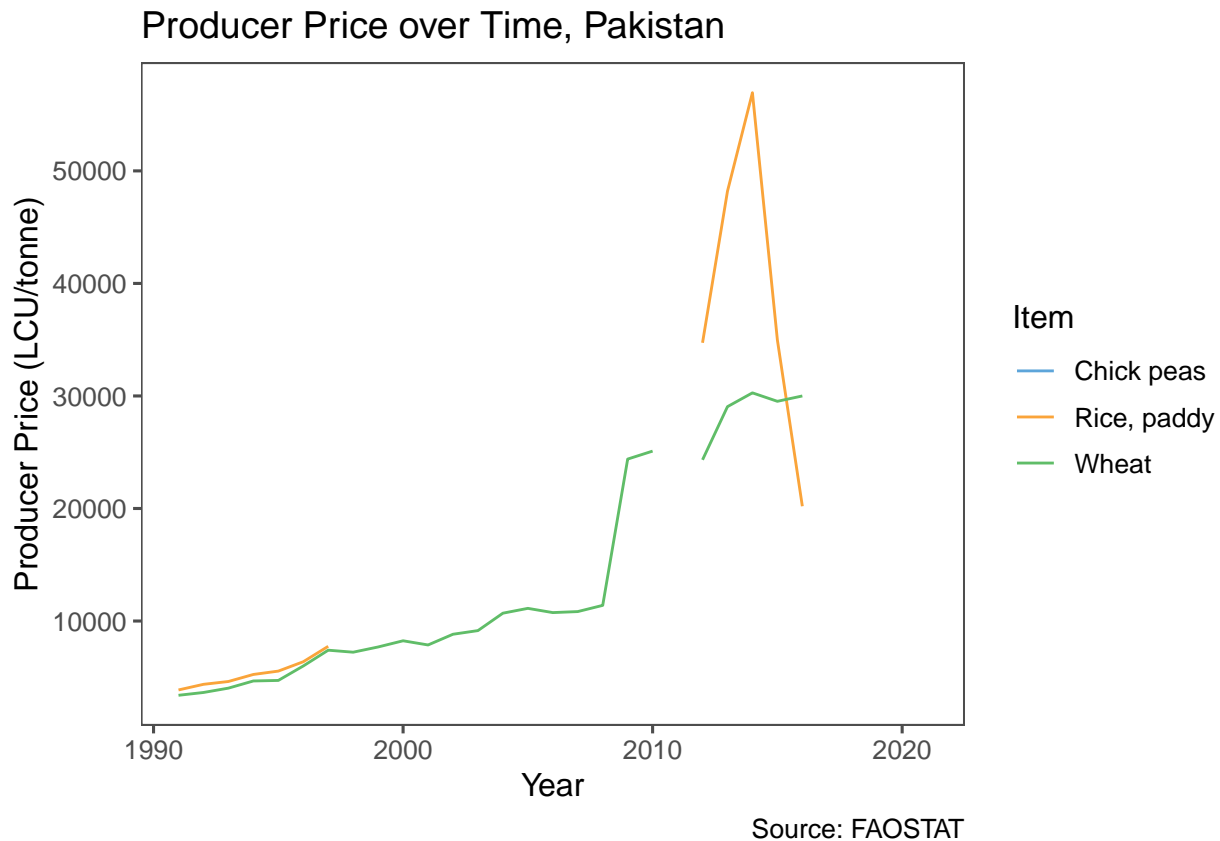




Source: FAOSTAT

There is a sharp drop in Rice yields in 2018. Need to look into that. Otherwise, chickpea yields remain roughly flat over the past 30 years, and also do not decrease significantly in area harvested.

Lets look at prices as well.



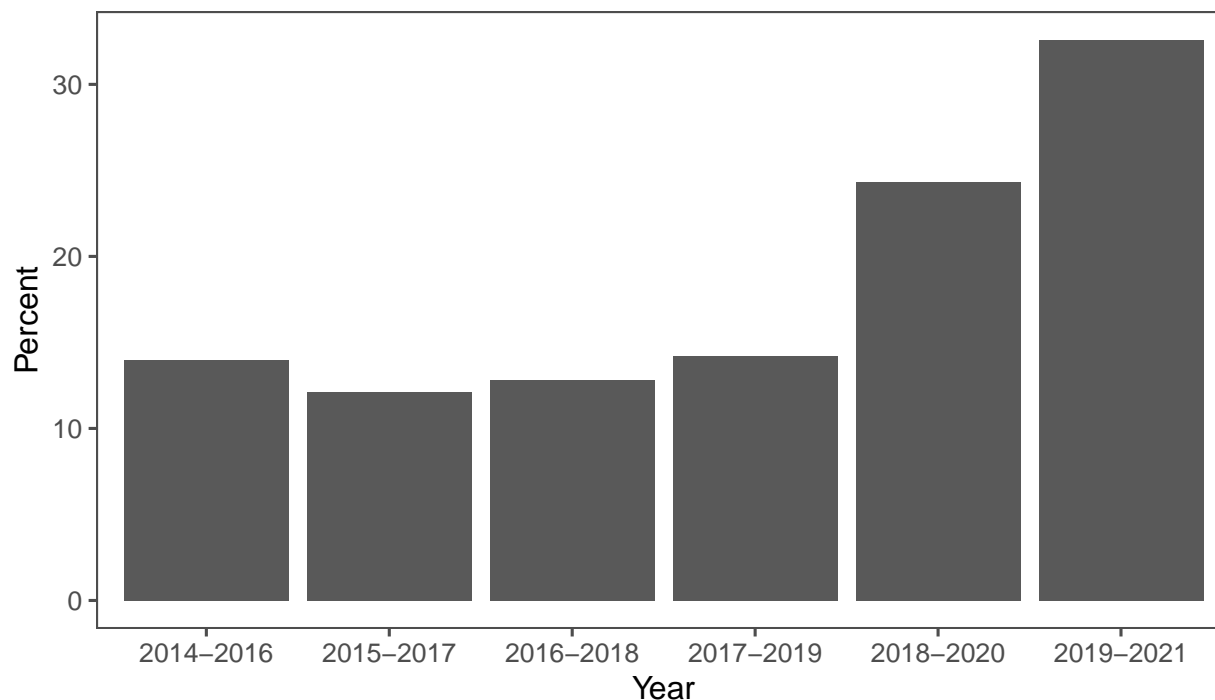
### Atifs Questions

- What does “food security” for Pakistan look like historically? I think Pakistan is now a net importer of food/calories. How does it look historically?
  - Food security has multiple meanings in this context - one, does Pakistan produce enough for itself or does it need to import food, and two, do people have enough to eat. The questions are directly related. The three year averages imply that undernourishment and food insecurity have risen dramatically in the past few years, but there may be a short spike during the covid years which then has gone away.
  - In KG terms, from 2010-2019, Pakistan is still a net exporter of food. But food per capita has remained flat, while GDP per capita has increased. People are richer, but the same quantity of food is available. Calories per capita has also remained flat. The implication should be that there is food inflation - more money, chasing same amount of food.
  - The data we have from FAOSTAT only goes up til 2019. We became a net wheat importer in 2021, so this switch isn't yet visible in the data. I'd like to stick to FAO.
  - One thing we haven't done is derive the calories per kg conversion, which we can do by dividing the kg of food by the calories per day item. Then can look at import/export, convert them to calories and see if we are net importing calories or not. As it is, in KG terms, there is not much change in the past decade. Need older data.
- How does food intake per person rise with GDP per person, and what does that imply for Pakistan's food needs IF it grows at a rate it needs to (say at least 6 percent per year)? Basic analysis like this would suggest the growth in food production needed for Pakistan to grow sustainably, while guaranteeing “food security”

- The above are more macro / strategic questions. Good to know in the background. Your questions are more focused. I think a deeper dive into causes of lower yield in the main crops and potential misallocation of crops would be useful. For example, how important is the subsidization of sugar-cane (a water-intensive crop) as a drag on food production overall?
  - Yes - effect of sugar-cane subsidization fascinating. Misallocation story good.
- You should talk to Ahyan and Faizaan as well – and also Aamir Aziz at HBL. I am meeting him on the 23rd when I am back in Princeton (currently in London). If you are around, I can introduce him to you as well.
  - Will speak to Faizaan tomorrow 2pm. Will ask him about getting in touch with Ahyan as well.
  - Sort of messed up this Aamir Aziz convo, as I thought it was September 23 but it was actually today. Oh well.
- Israel and Netherlands are two countries to look into on technology etc. Quite impressive.
- I think figuring out a “business case” and a tech/consulting company in the agri space has potential ... I always find the idea fascinating.

## Food Security

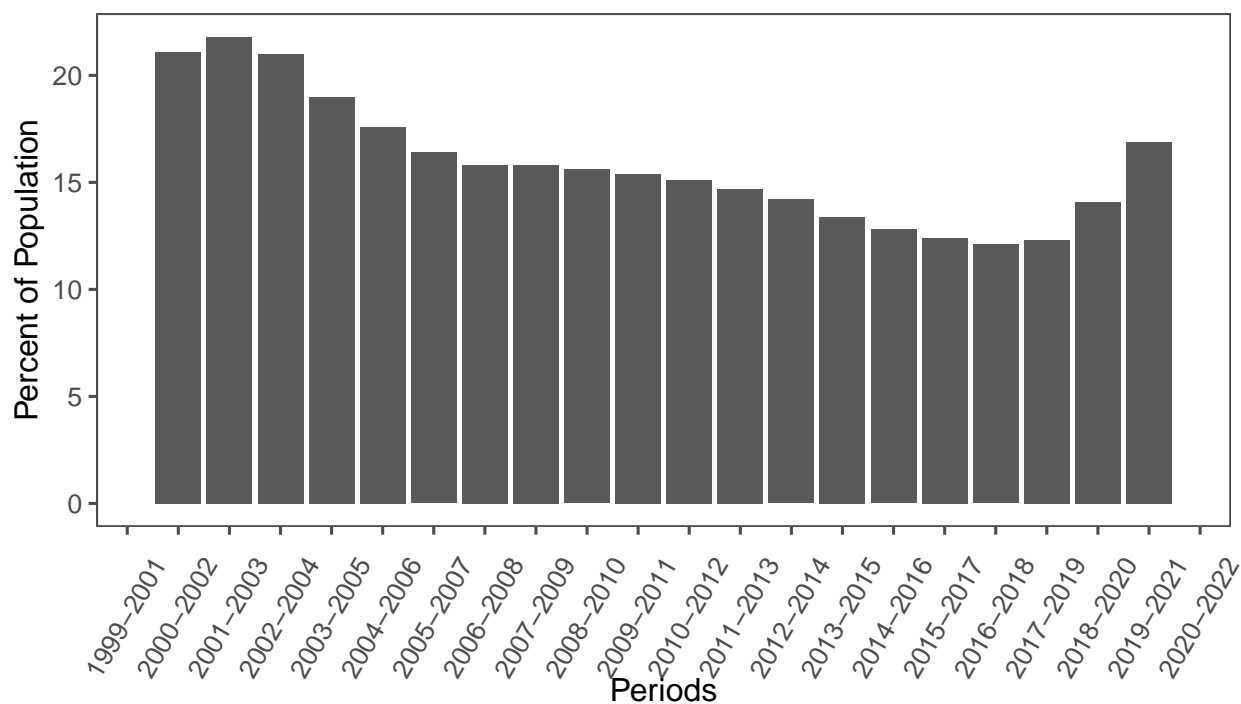
### Prevalance of moderate or severe food insecurity (3–year average)



Source: FAOSTAT

## Prevalence of undernourishment in Pakistan

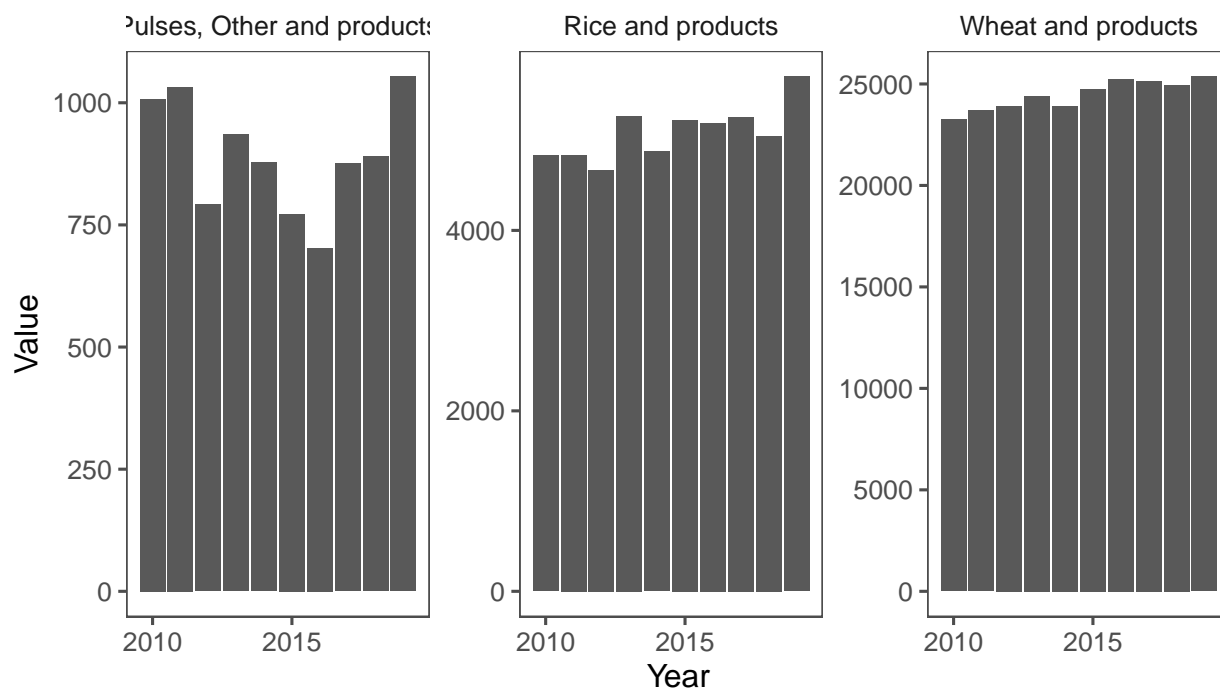
3-year average



Source: FAOSTAT

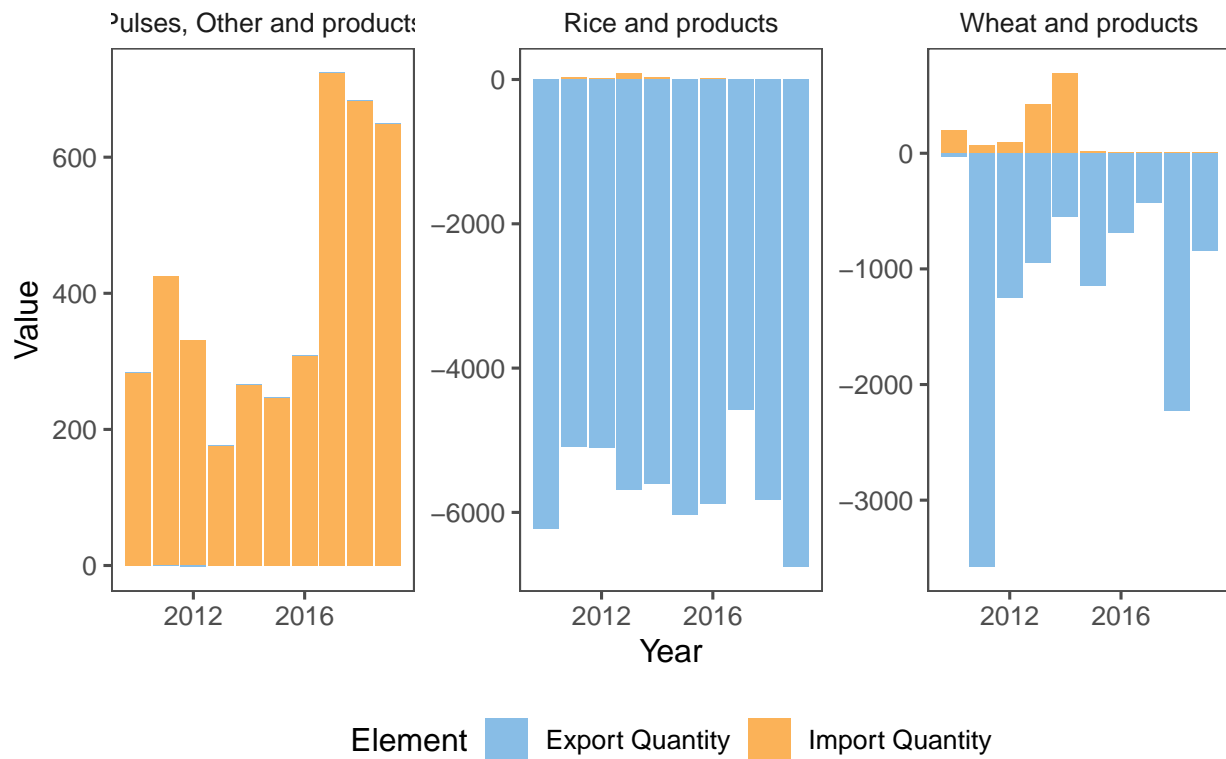
## Domestic Supply of Food Items

Production + Import – Export



Source: FAOSTAT

## Trade Balance over Time

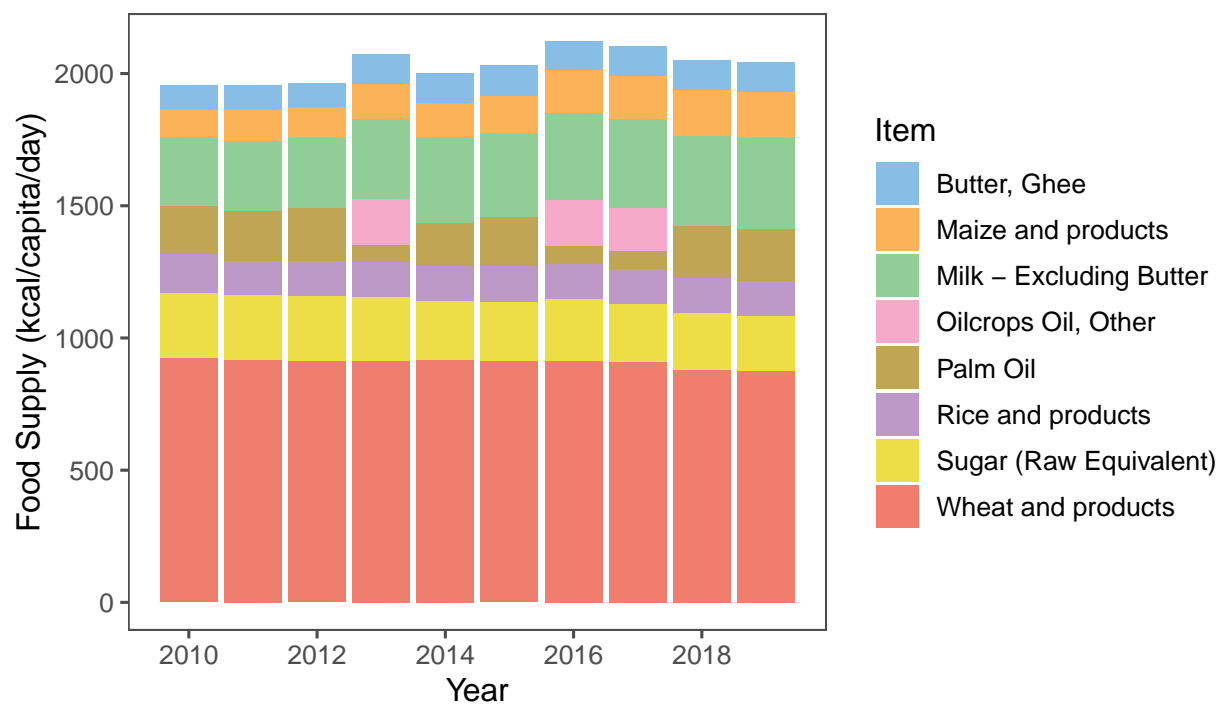


Major contributors to food supply - how many of these items are net imported? And has that been increasing?

I am also curious how this was constructed. Is it just food availability converted into calories per capita per day? How can we construct consumption patterns on the opposite side.

## Major Contributors to Pakistans Food Supply

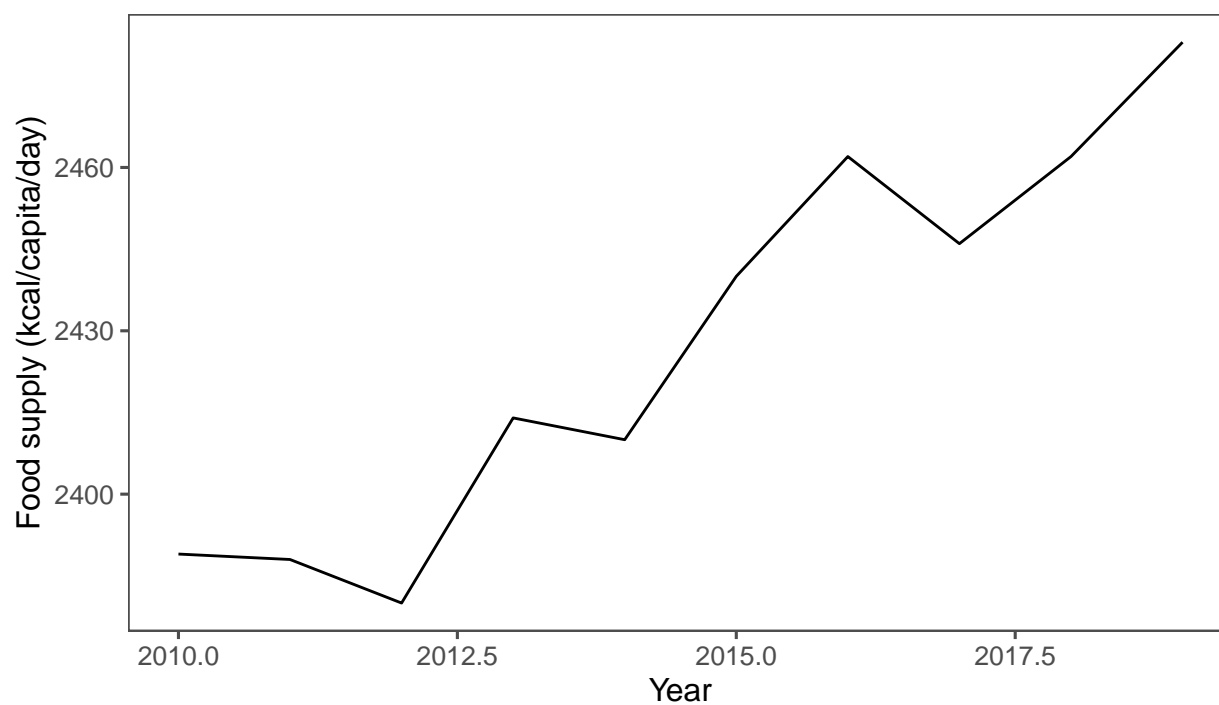
Contribute over 50 kcal per day per person



Source: FAOSTAT

## Food Supply over Time (kcal/capita/day)

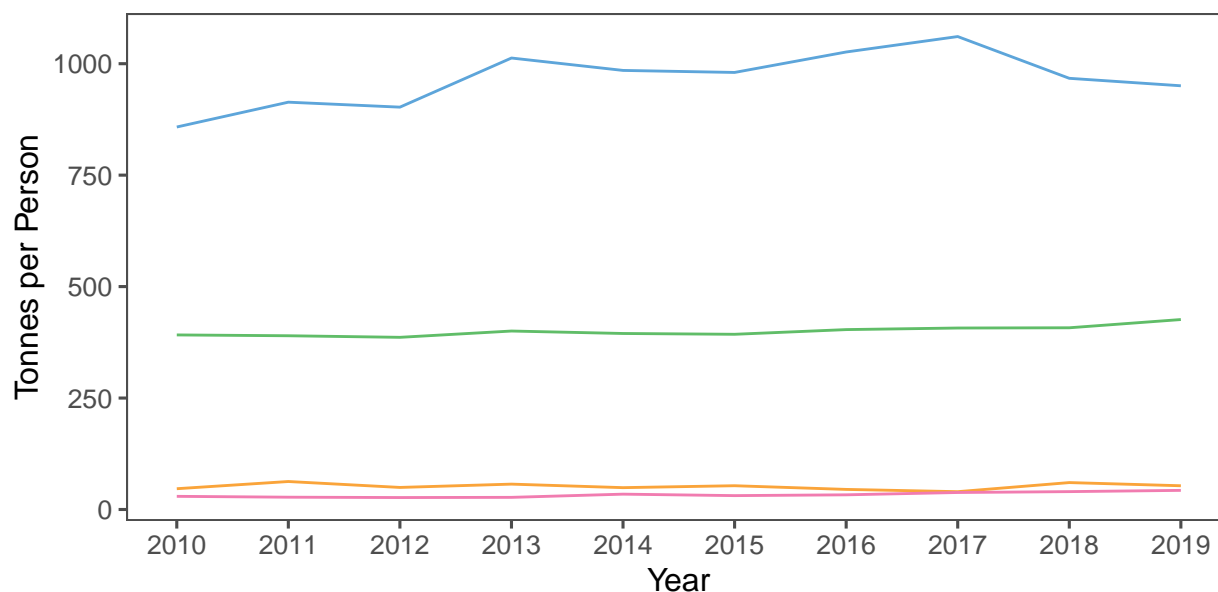
Pakistan



Source: FAOSTAT

## Crop Production, Trade Balance, and Availability

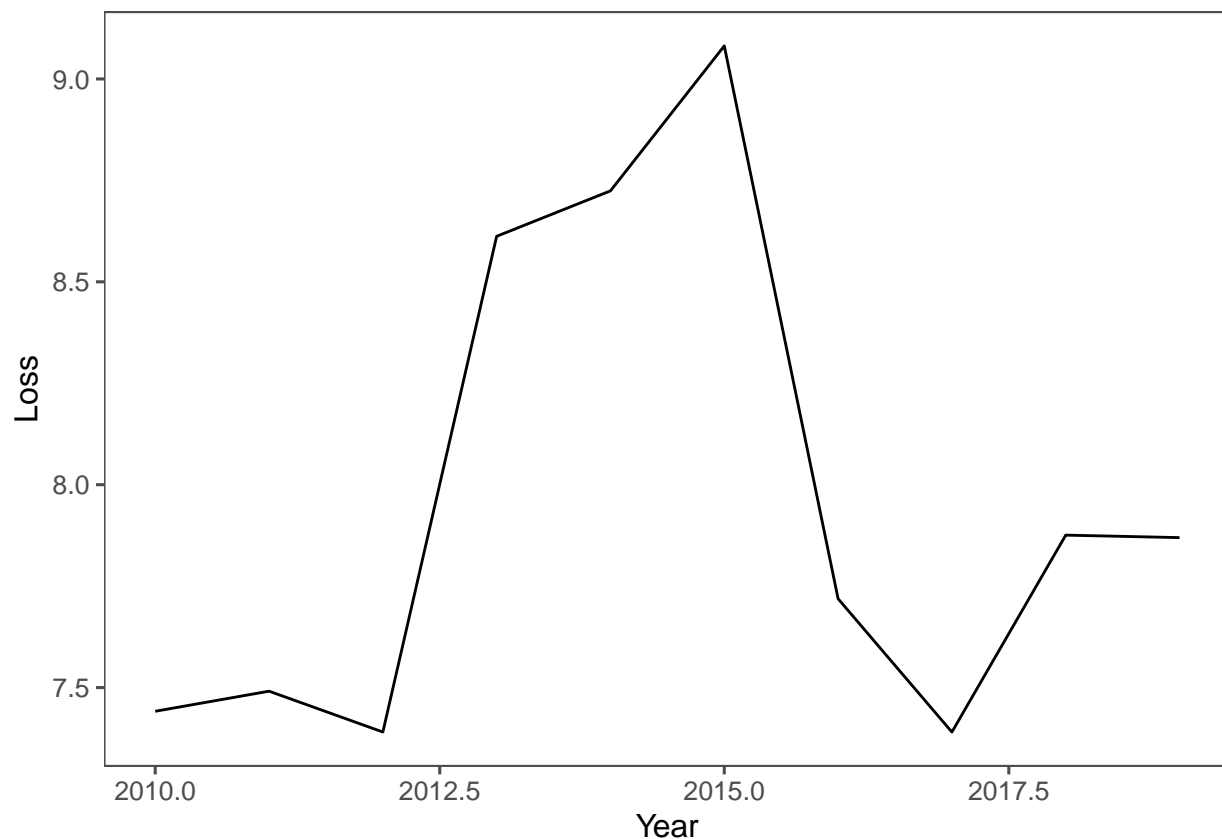
Pakistan



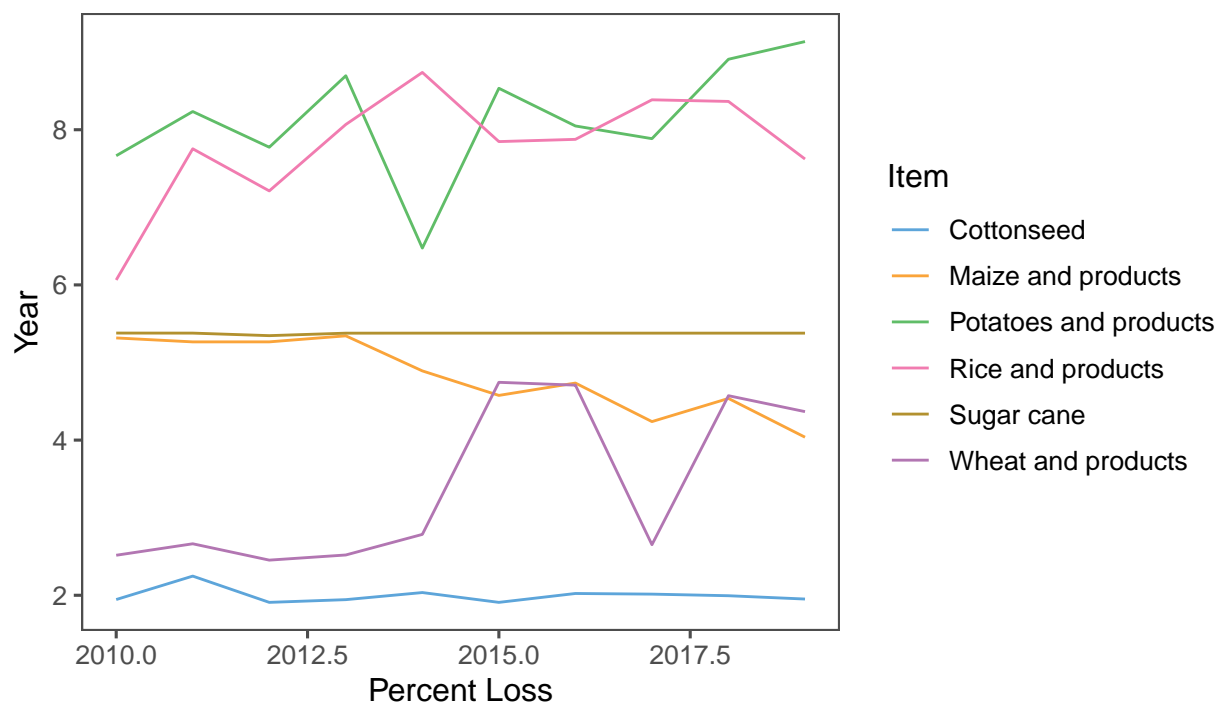
Crop Production per Capita    Export Quantity per Capita    Food Quantity per Capita    Imports per Capita

Source: FAOSTAT

Interested in losses as a proportion of the domestic supply. Seems it has roughly stayed between 7.5% - 9%, with Rice and Potatoes on the upper end of the spectrum here. However, no real trend, other than potatoes increasing in past few years. It would be interesting to see losses increasing with production quantity, indicating that there is a constraint on warehousing or cold storage for that particular crop.



Losses as a Proportion of Domestic Supply  
Major Crops, Pakistan



Source: FAOSTAT

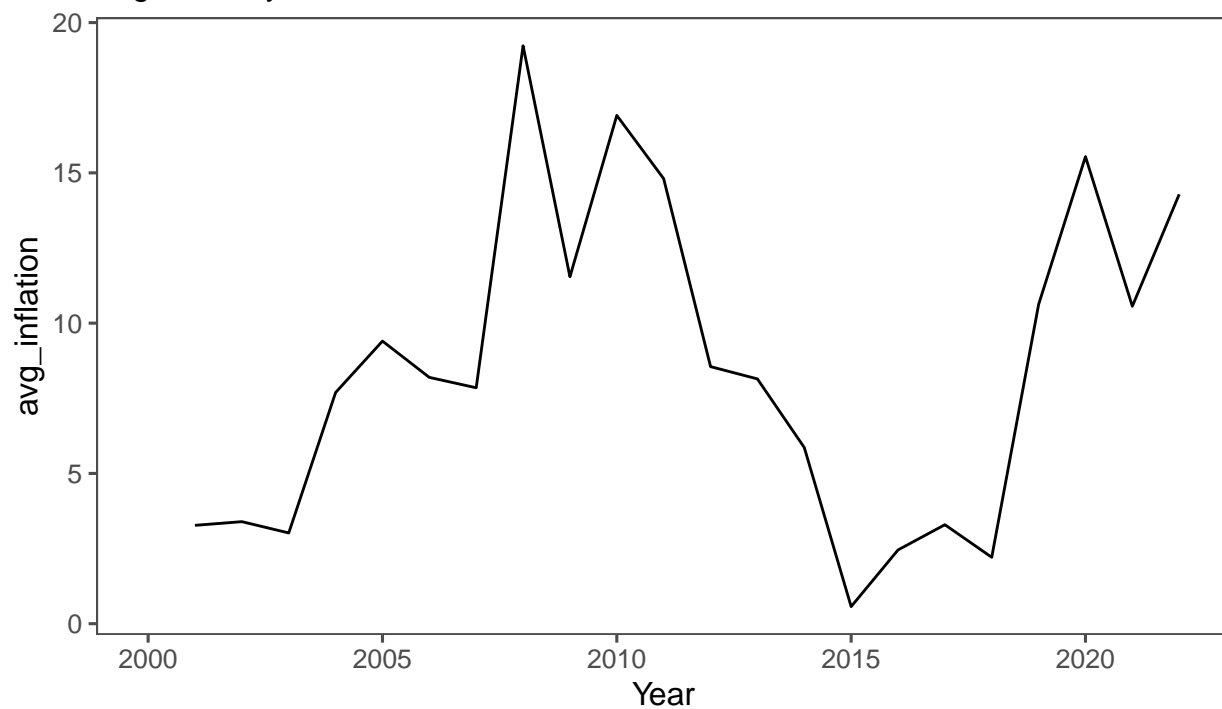
One graph to put together is the calories available per day, compared with GDP per capita. Would be great



if this could actually go til at least 2000. But it should show in the past decade that there must be food inflation. CPI should also go on the chart.

## Yearly Food Inflation, Pakistan

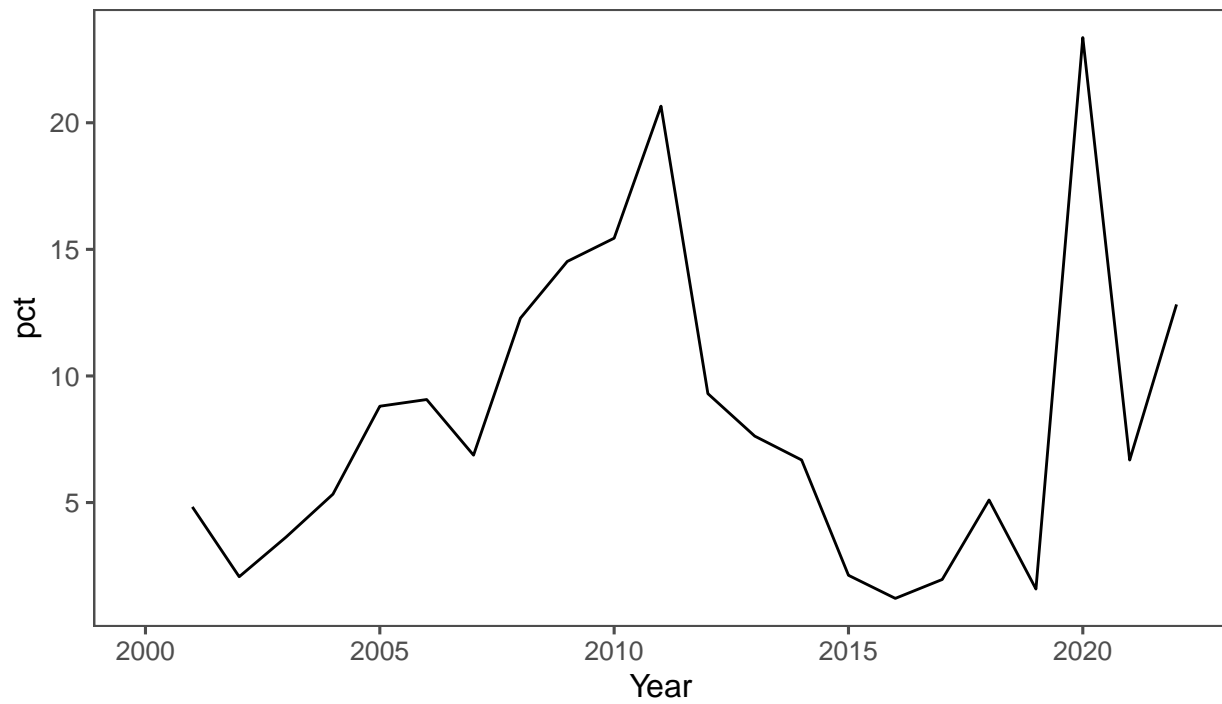
Avg of Yearly Inflation for each Month



Source: FAOSTAT

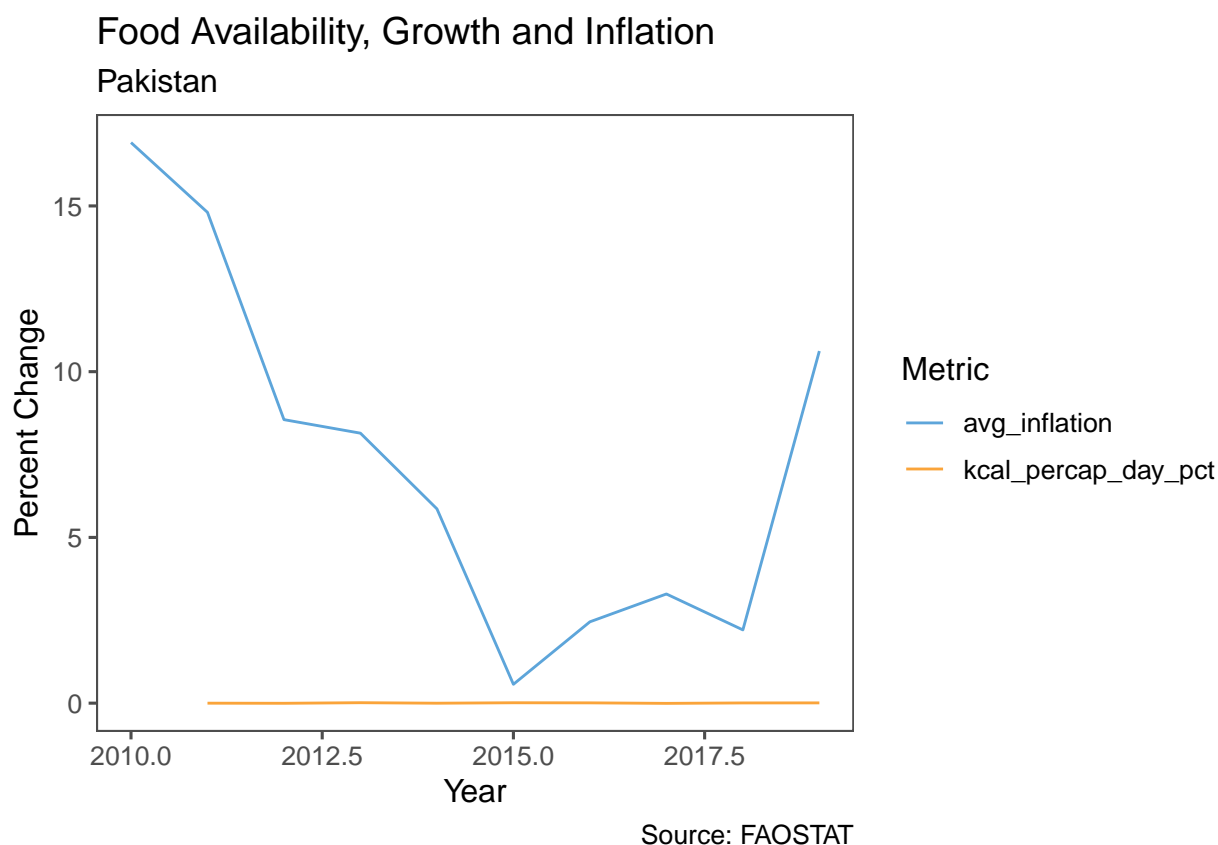
## Yearly Food Inflation, Pakistan

### Comparing Month of January



Source: FAOSTAT

Lets compare the inflation with food availability and then GDP per cap growth. Keep everything in percent so its comparable.



## Non Sequitors

Mostly unclosed threads I started thinking about.

Lets try a simple formula for “interesting” - if a crop has high production in world (low world ranking) and a low productivity, it should be at the top.

lets try rank \* relative yield first, and look at the top 20 by this metric.

Item	Index	World Rank (Tonnes Produced)	World Rank (Yield)	Yield / Avg Yield
Chick peas	1.48	5	42	0.30
Ginger	2.38	38	38	0.06
Okra	3.76	6	23	0.63
Dates	3.94	6	21	0.66
Onions, dry	4.24	7	97	0.61
Linseed	4.80	29	40	0.17
Lettuce and chicory	5.41	91	101	0.06
Eggplants (aubergines)	5.83	21	65	0.28
Chillies and peppers, dry	5.86	10	34	0.59
Mangoes, mangosteens, guavas	6.09	6	39	1.01
Seed cotton	6.11	6	36	1.02
Tomatoes	6.29	37	136	0.17
Fruit, fresh nes	6.43	4	23	1.61
Spices nes	6.46	8	17	0.81

Item	Index	World Rank (Tonnes Produced)	World Rank (Yield)	Yield / Avg Yield
Sugar cane	6.64	6	43	1.11
Bastfibres, other	6.74	20	19	0.34
Roots and tubers nes	6.83	4	9	1.71
Millet	6.93	14	62	0.50
Jute	7.10	17	14	0.42
Wheat	7.44	9	64	0.83

It turns out this list varies a lot year by year. Rankings is going to be volatile in general. We need a smoother metric which depends on relative volume produced. We can construct this by using a percentile? We want our position in the distribution. We can then smooth that over 2 years or so.

Item	Yield vs World Avg	Volume vs World	
		Avg	Net Export
Fruit, fresh nes	1.61	8.99	-17100
Mangoes, mangosteens, guavas	1.01	3.86	NA
Seed cotton	1.02	3.63	NA
Roots and tubers nes	1.71	3.63	NA
Wheat	0.83	3.39	NA
Sugar cane	1.11	3.05	NA
Oranges	0.81	2.64	2045
Onions, dry	0.61	2.36	51654
Dates	0.66	2.35	62880
Apricots	0.82	1.82	-12932
Potatoes	1.19	1.78	110648
Spices nes	0.81	1.72	69930
Fruit, tropical fresh nes	0.90	1.58	NA
Tobacco, unmanufactured	1.17	1.58	-13717
Chick peas	0.30	1.48	NA
Chillies and peppers, dry	0.59	1.33	2637
Carrots and turnips	0.60	1.10	55
Rice, paddy	0.60	1.06	-32046
Millet	0.50	0.97	-2318
Maize	1.12	0.96	-22487
Pumpkins, squash and gourds	0.55	0.94	NA
Tangerines, mandarins, clementines, satsumas	0.74	0.88	NA
Sesame seed	0.58	0.66	40326
Okra	0.63	0.59	NA
Cauliflowers and broccoli	1.06	0.58	1081
Beans, dry	0.46	0.50	NA
Peas, green	1.25	0.47	627
Watermelons	0.54	0.45	-389
Vegetables, fresh nes	1.36	0.45	22973
Apples	0.46	0.45	-43196
Lemons and limes	0.44	0.42	183
Tomatoes	0.17	0.38	-37293
Almonds, with shell	0.81	0.34	-104
Nuts nes	0.30	0.29	305
Rapeseed	0.57	0.26	NA
Peaches and nectarines	0.70	0.25	NA
Plums and sloes	0.93	0.25	107

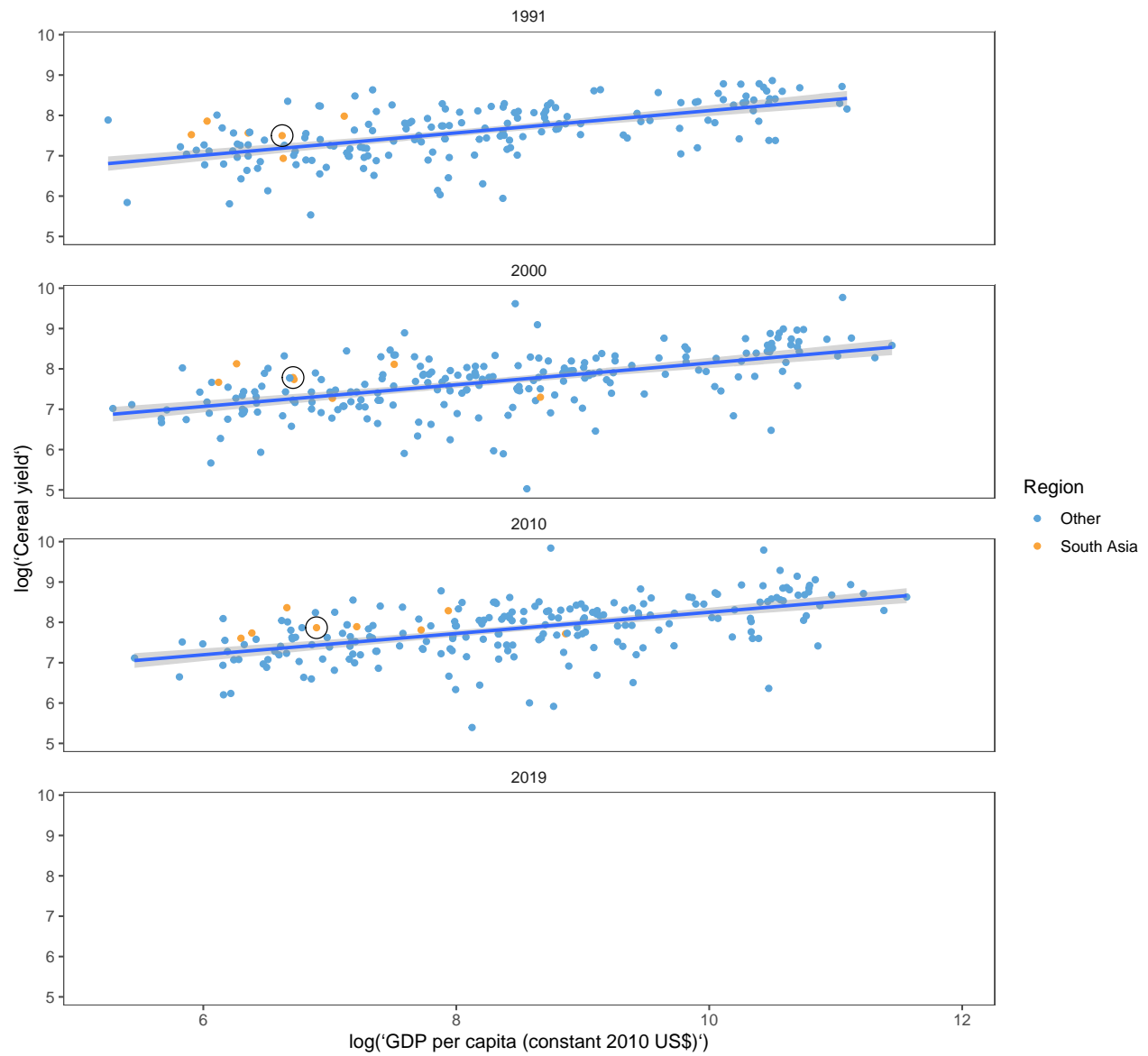
Item	Yield vs World Avg	Volume vs World	
		Avg	Net Export
Sorghum	0.22	0.24	-67
Walnuts, with shell	2.32	0.22	-11021
Sunflower seed	0.75	0.18	-4522
Peas, dry	0.36	0.17	NA
Garlic	0.98	0.16	-56780
Groundnuts, with shell	0.44	0.16	NA
Bananas	0.22	0.15	33009
Spinach	0.85	0.13	NA
Cabbages and other brassicas	0.61	0.11	5817
Berries nes	0.57	0.10	NA
Eggplants (aubergines)	0.28	0.09	NA
Grapes	0.53	0.09	NA
Pulses nes	0.53	0.07	NA
Cucumbers and gherkins	0.36	0.07	-17722
Cherries	0.37	0.06	NA
Lentils	0.39	0.04	NA
Papayas	0.21	0.04	NA
Barley	0.29	0.04	-2385
Linseed	0.17	0.03	NA
Pears	0.62	0.03	122
Castor oil seed	1.18	0.03	NA
Bastfibres, other	0.34	0.03	NA
Melons, other (inc.cantaloupes)	0.23	0.02	-489
Beans, green	0.61	0.02	NA
Coconuts	1.16	0.01	-4390
Sweet potatoes	0.79	0.01	NA
Figs	0.43	0.01	-182
Sugar beet	0.74	0.01	NA
Pistachios	1.42	0.01	-3949
Lettuce and chicory	0.06	0.00	-612
Jute	0.42	0.00	-23665
Ginger	0.06	0.00	-82690
Pigeon peas	0.46	0.00	NA
Soybeans	0.48	0.00	-754878

I will need to get more data from the census here: <http://mc2020.pbos.gov.pk/Dashboard/Default.aspx>

It can be scraped.

I will also use this for district-level crop output (<https://crs-agripunjab.punjab.gov.pk/node/165#overlay-context=reports>)

# Comparing Cereal Yields in Agriculture Pakistan circled



Source: World Bank