

The long and short (run) of UK agricultural prices

a cointegration analysis

The questions

What?

1. Do input price shocks pass through to output prices?
2. How quickly do input and output prices react to exogenous shocks?
3. How complete is passthrough of shocks?

Why?

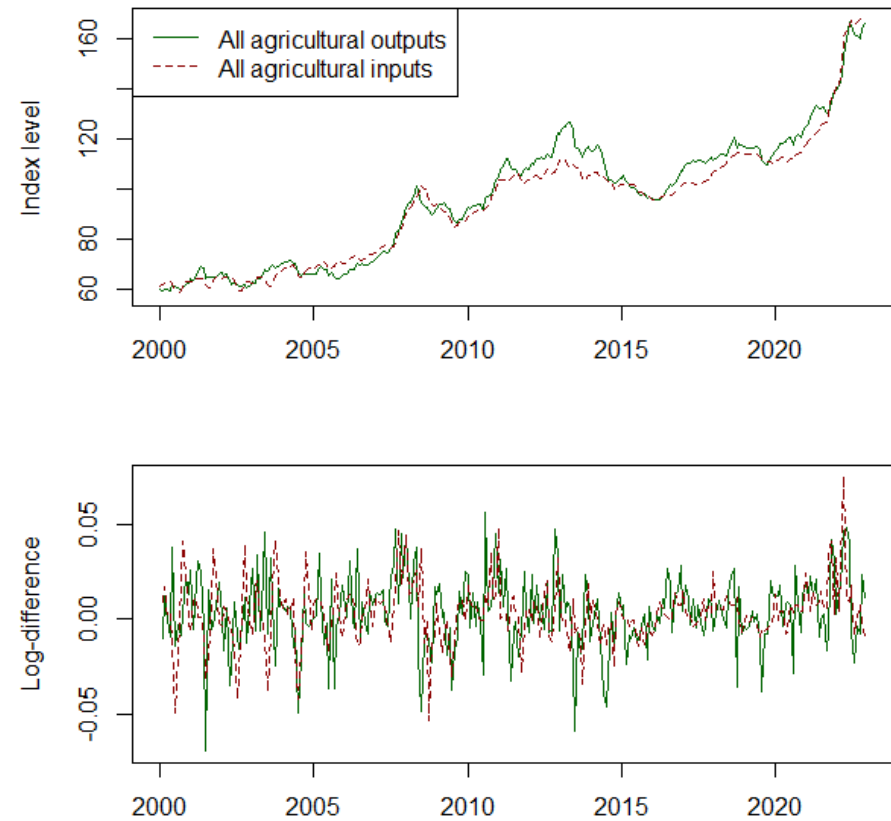
1. Possibility of a long run cost-price squeeze
2. Relevant to farmers, policymakers and others in the supply chain

The background

- Larue (1991) looked at farm input, farm output, and retail food prices in Canada. Found farm output prices were weakly exogenous, adjustment comes from input and retail prices.
- Moss (1992) found no evidence of cointegration, suggesting the possibility of a long-run cost-price squeeze.
- Pappas & Papadas (2015) studied the same question as Larue but looked at Greek data. Found cointegration, both farm output and input prices weakly exogenous.
- Campiche et al. (2006a) looked at aggregated input and output prices, finding full pass-through in the long run. A separate paper (2006b) found the same for individual commodities.
- Davidson et al. (2016) looked at (inter alia) passthrough of shocks from global commodity prices to UK retail food prices.

The data

- Agricultural price index (Defra):
 - all agricultural inputs
 - all agricultural outputs
- Producer price index (ONS)
- 2000-2022, monthly

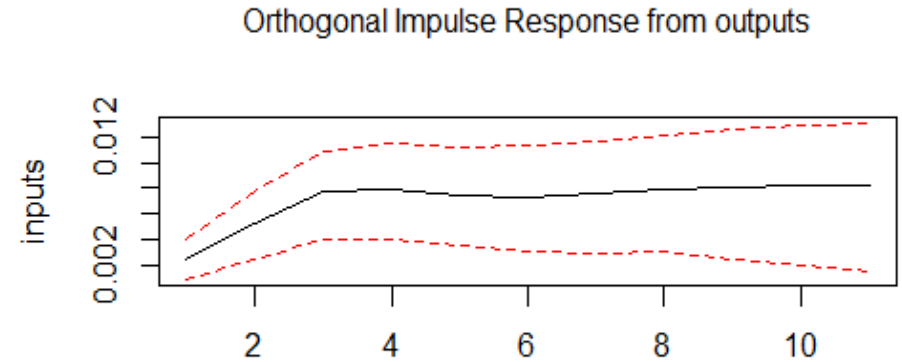


The modelling

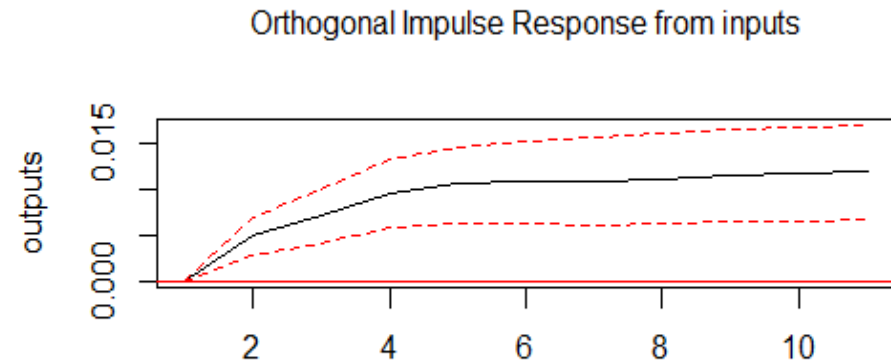
- (Logged) data showed evidence of a unit root in levels. Difference stationary. Robust to different test specifications. Data are integrated of order one.
- Bivariate model.
- Information criteria suggested optimal lag order of *4 months*
- Evidence of cointegration, robust to different model specifications. Case 3 (unrestricted constant) was most appropriate.
- Estimated a vector error correction model.
- Post-estimation tests suggested a well-behaved model + residuals.

The short term

- Error correction terms have anticipated signs and magnitudes, suggesting adjustment in response to disequilibrium.
- Output prices adjust more rapidly than input prices, approximately 8% per month. Half life of around 9 months.
- Input price adjustment (3% per month) not distinguishable from zero at conventional significance levels.



95 % Bootstrap CI, 500 runs



95 % Bootstrap CI, 500 runs

The long term

- It wasn't possible to reject the null hypothesis that in the long run there is (eventual) full pass through of shocks between input and output market.
- This suggests a long run cost price squeeze is not possible at the aggregate level.

The upshot

- This analysis suggests input and output prices share a long-run common trend.
- Output prices adjust more rapidly than input prices, do more of the work adjusting to any disequilibrium. Liquid markets and commodity outputs may facilitate more rapid adjustments.
- Input prices' slower adjustment could be influenced by the presence of items like labour, electricity, which are more likely to be on longer term contracts that restrict price adjustment.
- Short term squeeze can still challenge farmers' cash flows. Despite this, Defra surveys show limited uptake of risk management tools.

Table 1: Percentage of farm businesses undertaking various risk management practices^{(a)(b)}, England

	Percentage of farm businesses (%)			95% Confidence Interval (%)		
	2007/08	2011/12	2016/17	2007/08	2011/12	2016/17
None of the practices listed	30	20	25	±2	±3	±3
Sell some commodities on contract basis	25	36	38	±2	±3	±3
Use selling groups and pools	21	25	26	±2	±3	±3
Purchase inputs on contract basis	29	36	35	±2	±3	±3
Make use of 'options' ^(c)	6	5	5	±1	±1	±1
Animal health insurance	13	16	15	±2	±2	±2
Crop damage insurance	11	11	10	±2	±2	±2
Using bio-security measures*	-	30	34	-	±3	±3
Lock into a fixed exchange rate	-	4	3	-	±1	±1

Source: Farm Business Survey, England 2007/2008, 2011/12, and 2016/17.

Based on responses from 1453 farm businesses in 2007/08, 1357 farm businesses in 2011/12, and 1269 businesses in 2016/17.

(a) Comparisons between years should be treated with caution. For more information please see the [comparisons](#) section.

*Signifies statistically significant difference when comparisons made between farms present in both 2011/12 and 2016/17.

(b) Respondents could select more than one option.

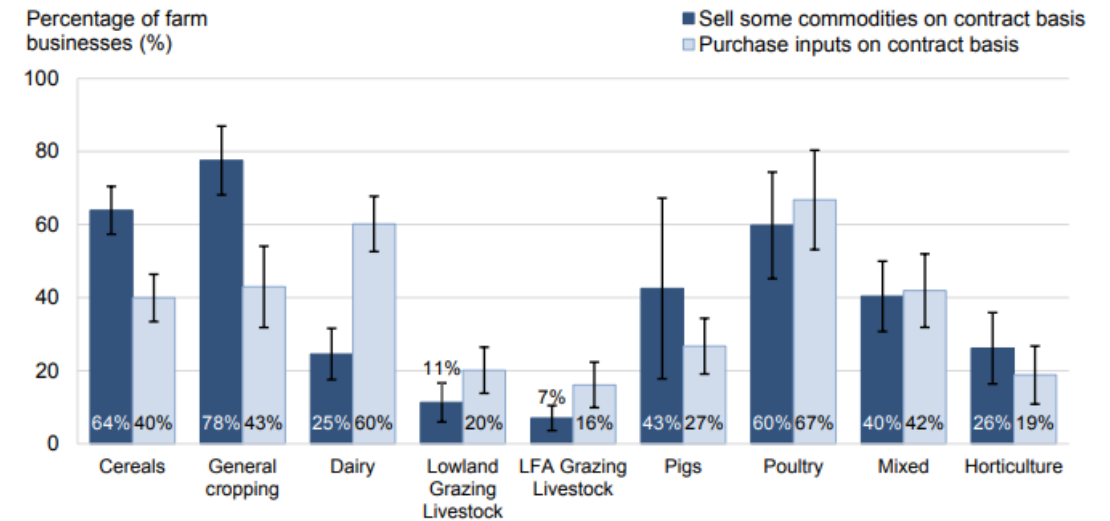
(c) For a definition of making use of options, please see the [definitions](#) section.

(Department for Environment, Food & Rural Affairs, 2018)

The upshot

- Substantial variation in risk management practices within and between farm types.
- New data forthcoming in April/May 2024.

Figure 4: Selling commodities and purchasing inputs on a contract basis by farm type, England 2016/17



Source: Farm Business Survey, England 2016/17.

(Department for Environment, Food & Rural Affairs, 2018)

The next steps

- More thorough testing for structural breaks – a definite risk in a time series this long.
- Consideration of other cointegration tests given limitations of the tests used.
- Testing for asymmetry in shock passthrough might be a (more) interesting question.
- Potential aggregation bias on the output side: disaggregated analysis may reveal different relationships

References

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- R packages: dplyr, forecast, janitor, lubridate, magrittr, purrr, readODS, readr, rvest, stringr, texreg, tidyr, tidyverse, tsDyn, **urca**, vars, zoo



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Applying these findings to the current market

Farming Economics

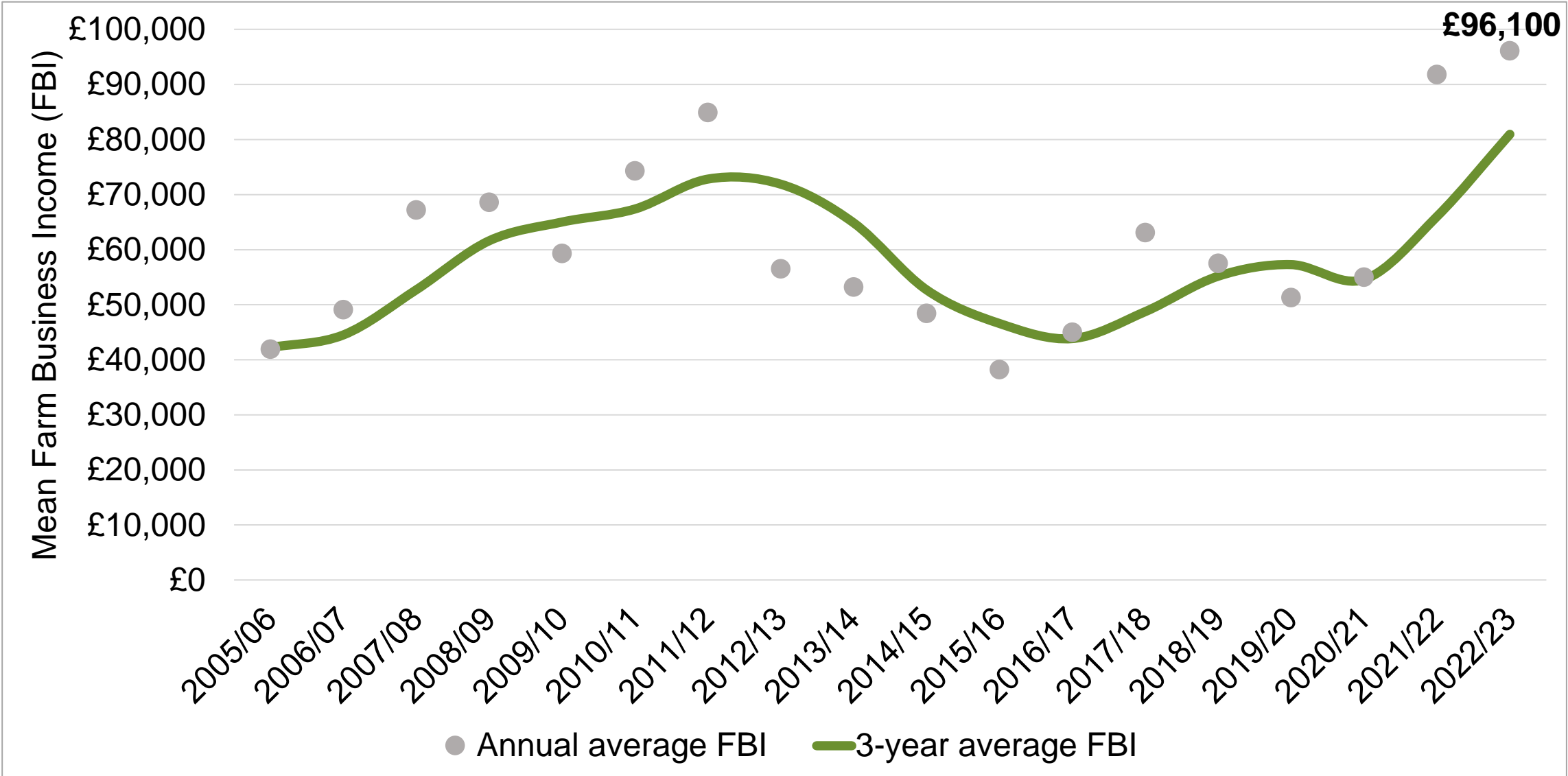


Forestry Commission
England

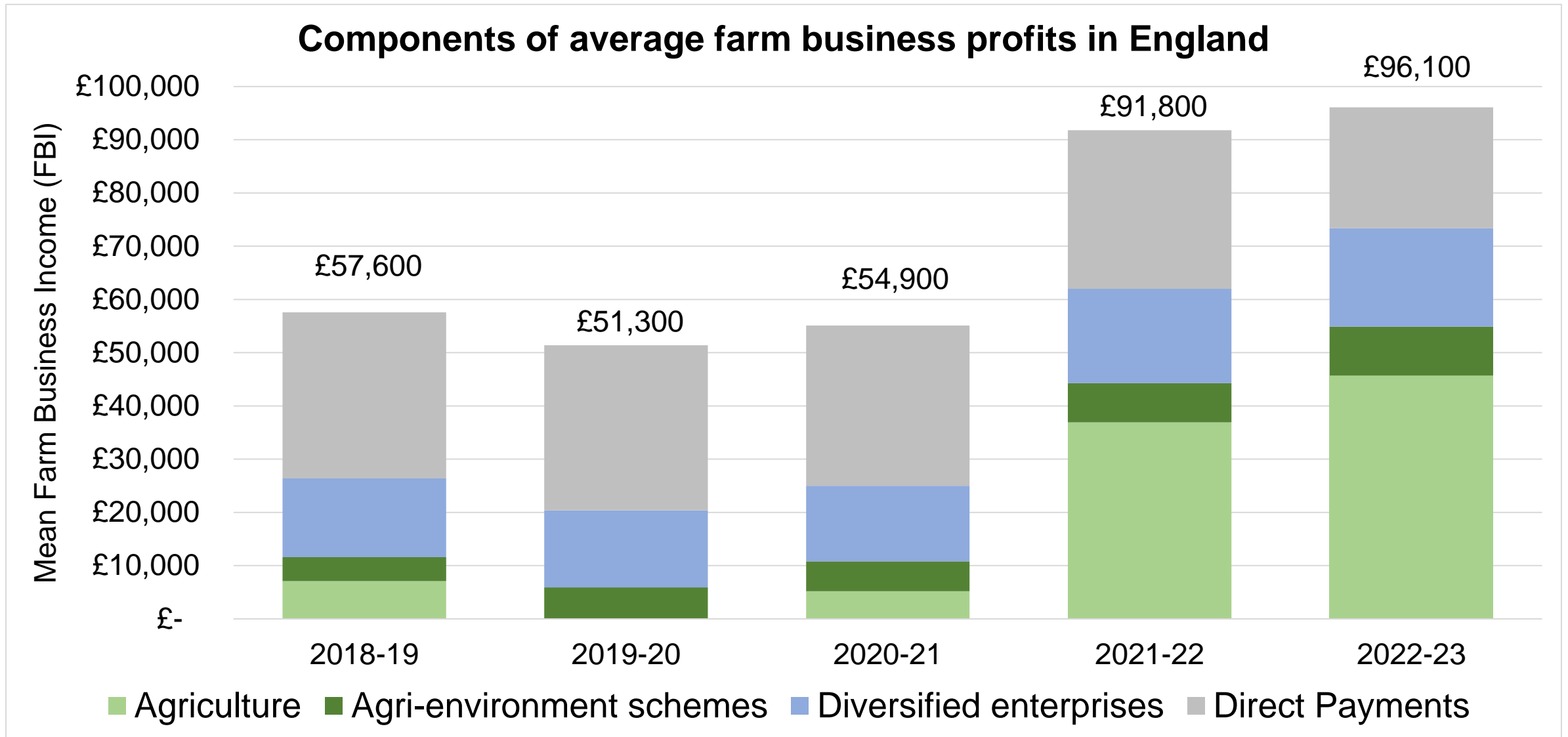


Environment
Agency

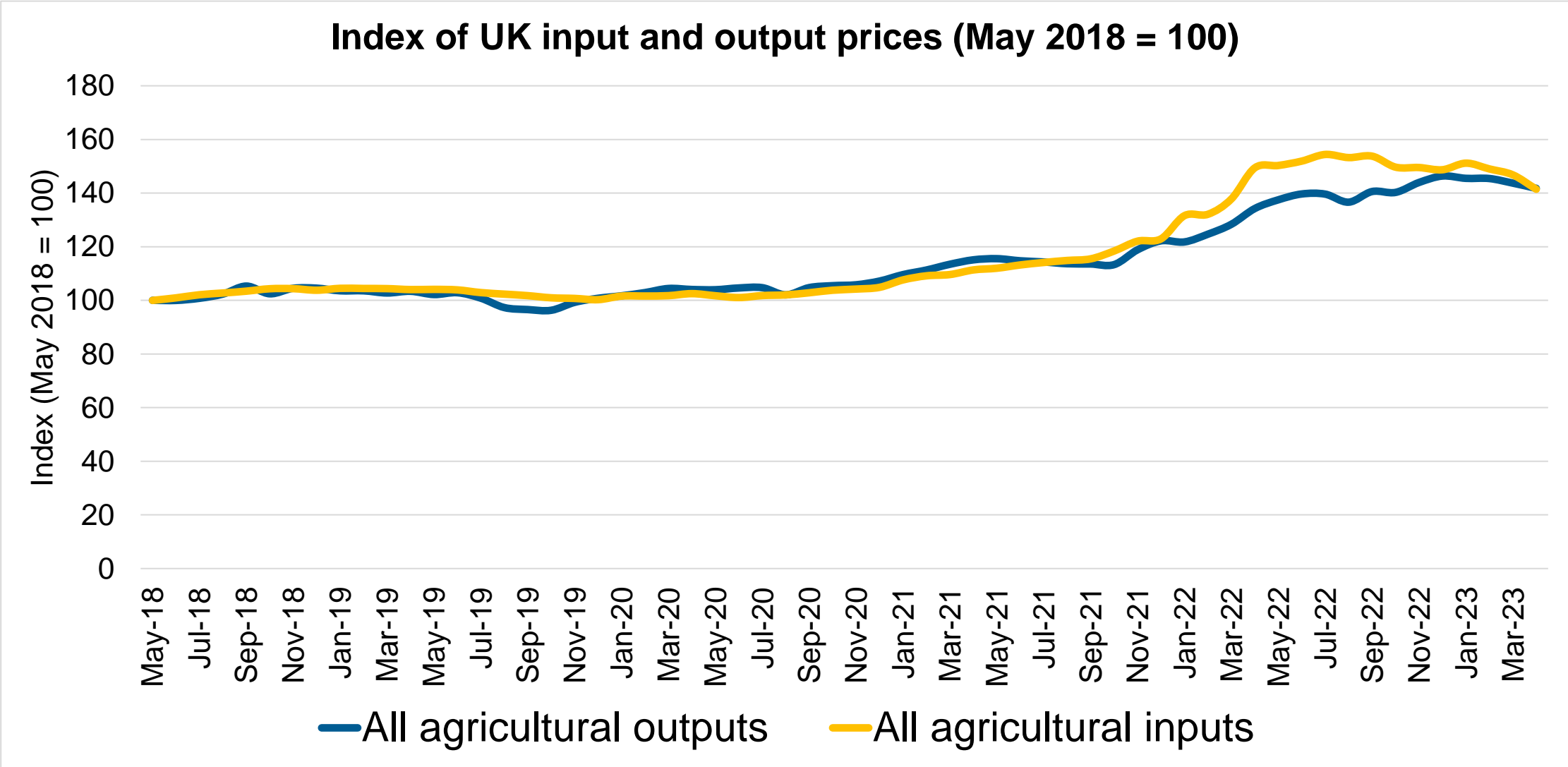
Real farm net profits (FBI) were at record highs in 2021/22 and again in 2022/23



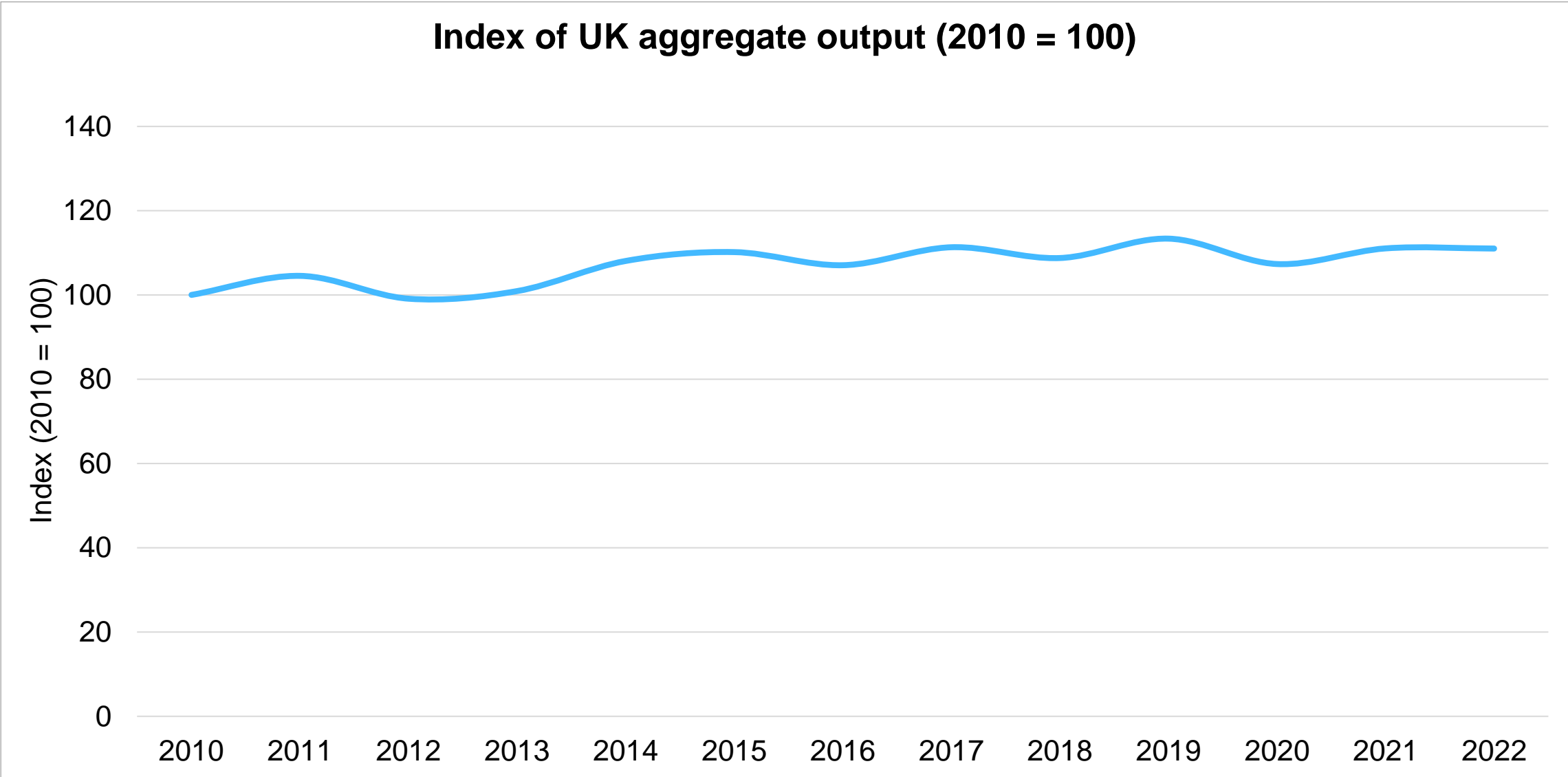
Record highs were driven by improved agricultural profitability



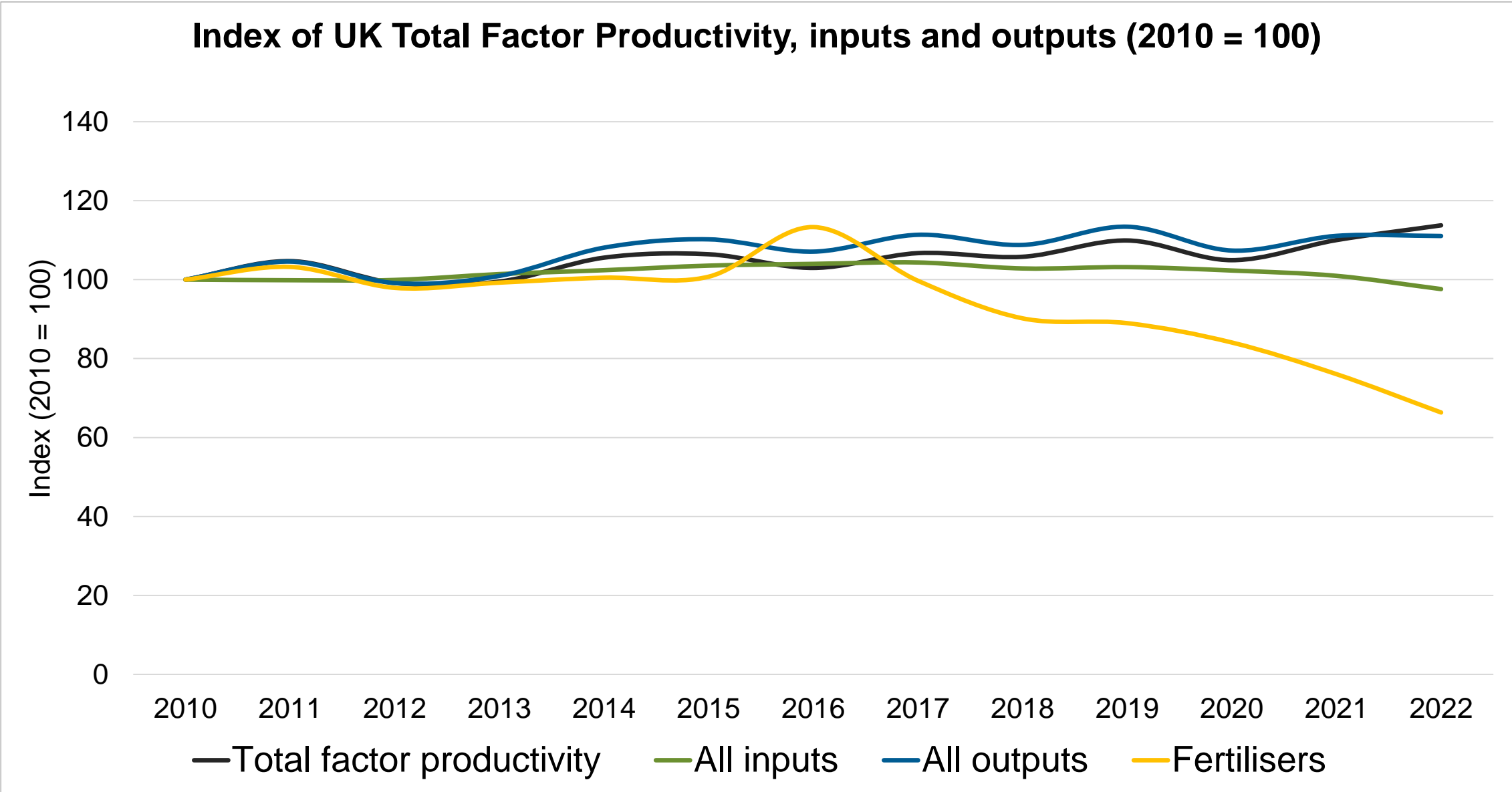
Large increases in input and output prices



Little change in output



Some response to price signals

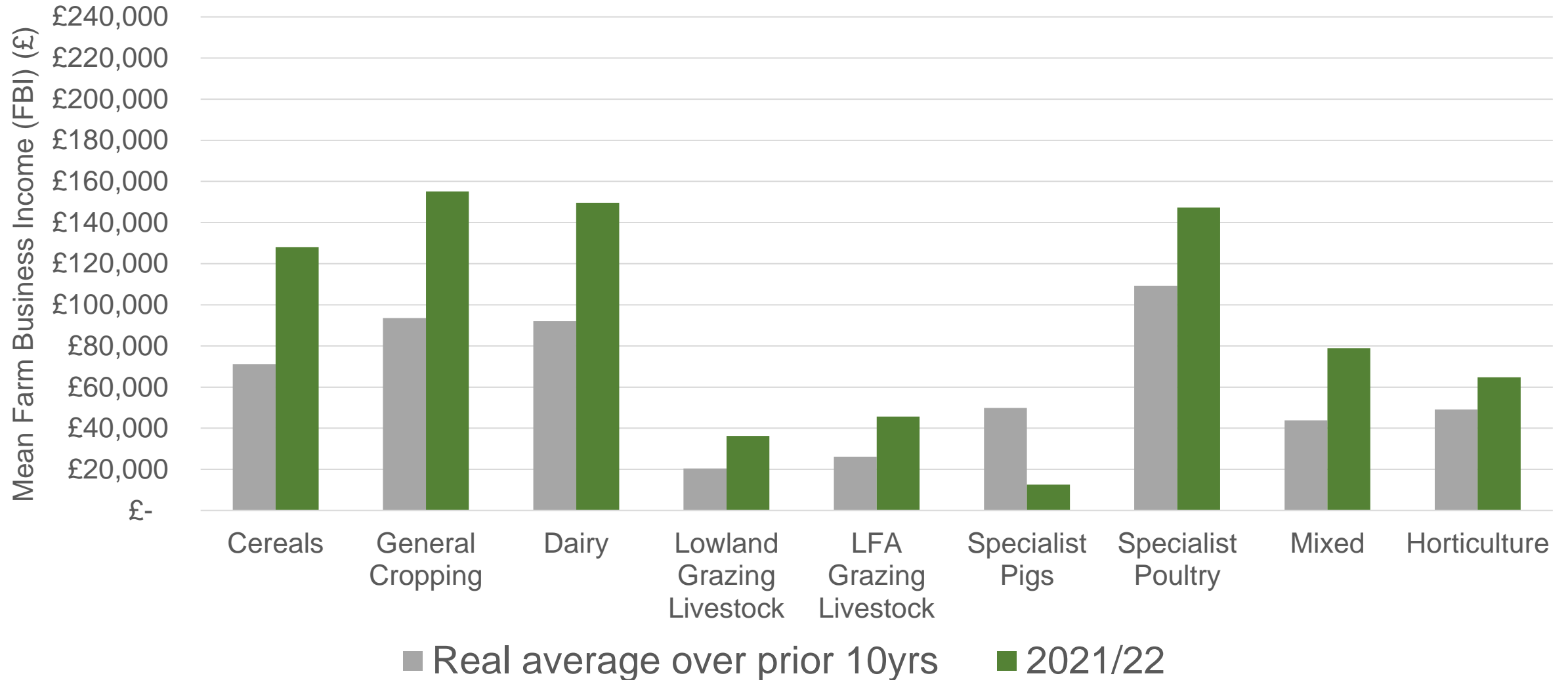


Musings on the future

- The insulating effect of high profits impacting behavioural change for some farms in the short-run
 - Farm Opinion tracker suggests this could be relevant to, at most, a small minority of farms
- The opportunity to realise business transformation
 - Increased reserves and stronger liquidity ratios
- Changes in agricultural profits
 - Input-output relationship returning to equilibrium, likely via output price adjustments
- Agri-environment scheme uptake
 - A decrease in the opportunity cost of participating in agri-environment schemes

Additional material – net profits (FBI) by farm type 2021/22

Comparing real net profits in 2021/22 with historical averages



Additional material – net profits (FBI) by farm type 2022/23

Comparing real net profits in 2022/23 with historical averages

