South African Reserve Bank
Occasional Bulletin of Economic Notes
OBEN/20/01

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Authorised for publication by:

Chris Loewald

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OBEN 2001* – February 2020

Food prices after the crisis – improving the forecasts

Patience Mathuloe and Rowan Walter[1]

Abstract

Our food CPI forecasts have been poor over recent years. As food and NAB inflation is a sizeable portion (17.2%) of headline inflation, improving our food forecasts implies more accurate targeted inflation projections. The large forecast errors can be ascribed to a combination of factors, with the most prominent being the shock to food prices following the severe drought of 2015/16 and it's after effects. To improve our forecasts, we rely on basic equations to project sugar, bread and cereals, and oils and fats inflation. We also inform some of the other large food CPI component forecasts using their PPI equivalents and enhance this with expert analysis. One food expert now expects food prices to remain muted at 4% in 2020. Our latest estimation for food and NAB inflation has been reduced further, from 4.7% to 4.4% for 2020.

1. Introduction

Following poor food price forecasts over the past few years we are trying to improve our projections. The large errors can be ascribed to a combination of factors, with the most prominent being the shock to food prices following the severe drought of 2015/16 and it's after effects. The uneven impact of the drought is visible in meat prices (almost a third of the food and non-alcoholic beverages (NAB) basket) only peaking one year later than bread and cereals inflation (just under 20% of the basket). Moderating international agricultural food prices since 2011, and a more recent de-coupling of international food from oil prices (during 2018) have also made food forecasting difficult. Together, this has resulted in a weakened relationship between global agricultural food prices and our domestic food prices. The more appreciated exchange rate after Nenegate, as well as a weak domestic demand environment further affected the forecasts. Lower than expected meat prices were a large culprit of the food CPI overestimation in 2018 and especially at the start of 2019. Early signs are that the foot-and-mouth disease that kept meat inflation in check in 2019 will continue to do so during 2020. To improve our forecasts, we rely on equations to project some of the components. This is further supplemented with expert analysis. One food specialist now expects food prices to remain muted at 4% in 2020. Our latest estimation for food and NAB inflation is reduced further to 4.4% for 2020.[2]

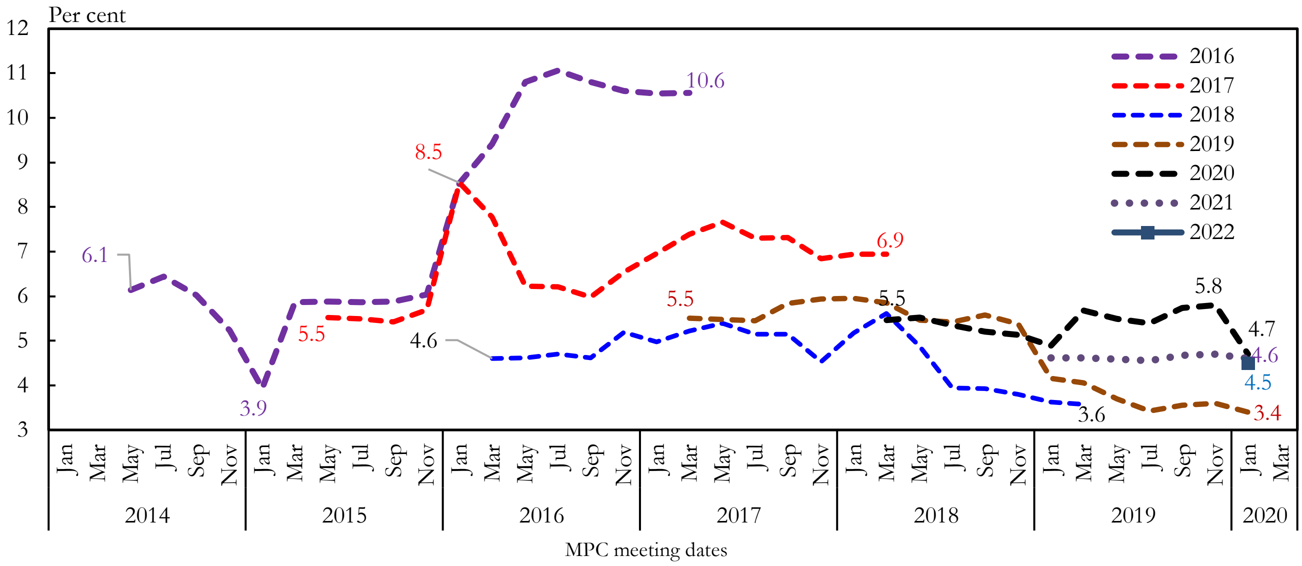
2. Food forecast errors

From our annual food and NAB inflation forecast errors in Chart 1 it is apparent that we only became aware of the likely intensity of the 2015/16 drought at the January 2016 MPC meeting. Our food forecasts for 2016 were consistently revised upward over the next three meetings, while for 2017 they were initially revised higher, before it became clearer that base effects would result in lower food inflation in 2017.

[1] Many thanks to Witness Simbanegavi, Daan Steenkamp and Nelene Ehlers for their valuable comments.

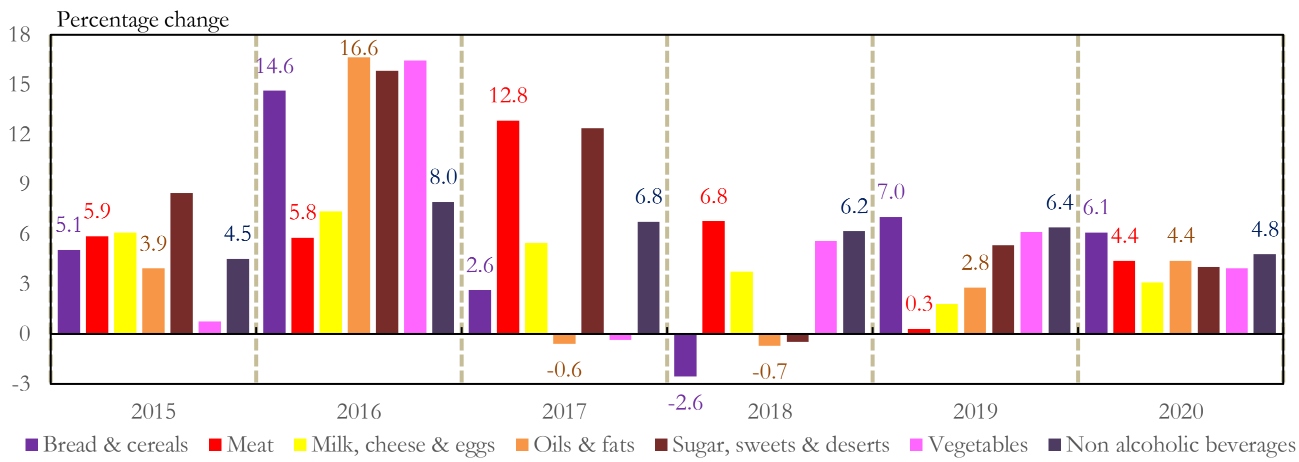
[2] There's optimism about SA's 2019/20 summer crop season, *agbiz agribusiness research*, by Wandile Shilobo, 29 January 2020. https://www.agriorbit.com/agrimarkets-optimism-about-sa-maize-harvest-in-2019-20

Chart 1: Evolution of the annual food & NAB inflation forecasts



Sources: Stats SA and SARB

Chart 2: Food & NAB inflation components



Sources: Stats SA and SARB

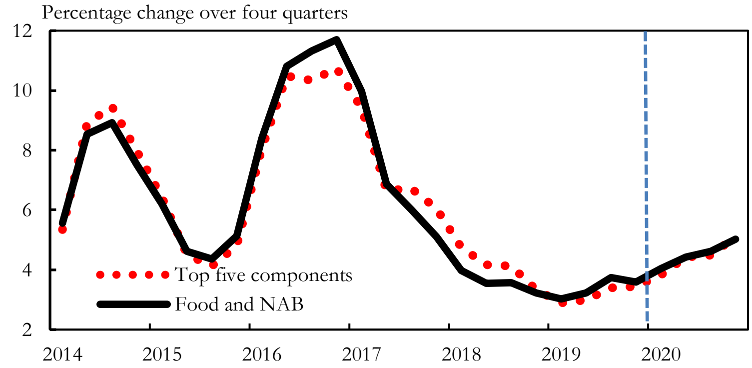
The lingering impacts of the drought on meat inflation, which peaked in 2017 (see Chart 2) - one year after the peak impacts on most of the other components (as farmers had to rebuild their depleted herds) - resulted in overall food inflation being still quite elevated in 2017. After the 2017 peak, meat prices then slowed more than anticipated in the second half of 2018. The impact from the sugar tax on non-alcoholic beverages in 2018 was disguised by low inflation in some components, as well as deflation in three food components. This all in turn contributed to the overestimation of food and NAB prices in 2018. Meat prices were also a culprit of the food CPI overestimation in 2019, which was related to the prevalence of the foot-and-mouth disease outbreaks during the year. Early signs are that this will continue to keep meat inflation in check during 2020 as well.[3]

[3] Thoughts on South Africa's food price inflation, *Agricultural Economics Today*, by Wandile Shilobo, 22 January 2020. https://wandilesihlobo.com/2020/01/22/thoughts-on-south-africas-food-price-inflation-2/

3. Improving the food and NAB CPI forecasts

As each food component is affected by different drivers, one way to improve our overall food CPI forecasts is to improve the projections of the most important individual components - those that have the largest weight and are simultaneously also the most volatile. A combination of the five largest components by weight bares a close resemblance to the overall food and NAB inflation since 2014 – see Chart 3. These five components comprise 83% of the overall index and are meat (32%), bread and cereals (19%), milk, cheese and eggs (15%), NAB (10%) and vegetables (8%).

Chart 3: The overall food and NAB CPI compared to the top five components by weight

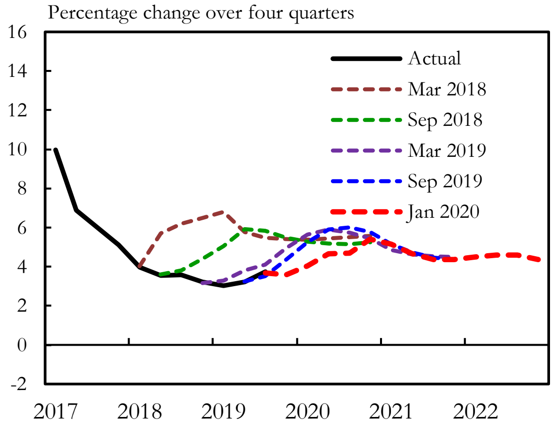


Sources: Stats SA and SARB

Ideally, we would like to have working equations for these top five components, but thus far we rely on a basic equation to project bread and cereals inflation (see section 5 below). Forecasts produced for three of the top five components (from MPC meetings as used for the Monetary Policy Review publications since March 2018) can be seen from charts 5 to 7. Here the medium term projections are adjusted so that the components add up to the food projections from the main forecasting model. The forecasts are also adjusted when available information from expert sources suggest that outcomes could be affected by unforeseen shocks, such as the foot-and-mouth disease in the case of meat prices. Given the limitations of the available information, these projections are used mainly for the near quarter or starting point, but they do act as a rough indication for up to one year ahead projections.

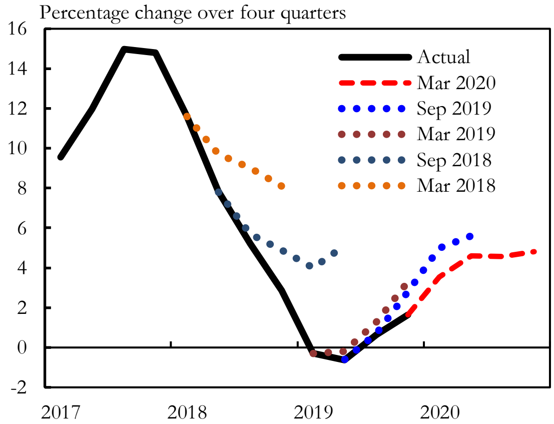
It is clear from the projections that meat inflation was significantly overestimated in early 2019 as a result of the foot-and-mouth disease outbreak. Aside from the overestimation at the March 2018 MPC, the bread and cereals inflation projections performed significantly better. Vegetables inflation is uniquely difficult to forecast given the seasonality in the data and was underestimated during 2018 and the start of 2019. It was however overestimated towards the end of 2019.

Chart 4: Evolution of the food & NAB inflation forecasts



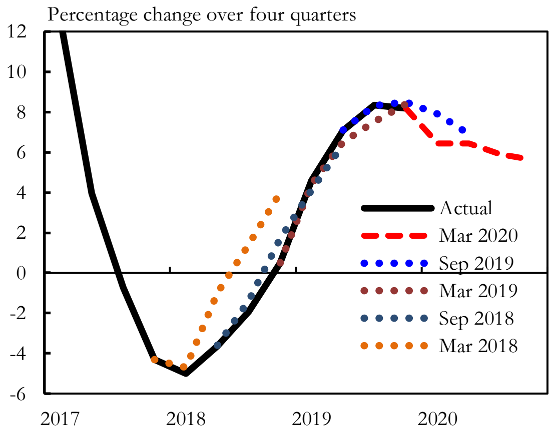
* Dottted lines indicate official SARB forecasts

Chart 5: Evolution of the meat inflation forecasts



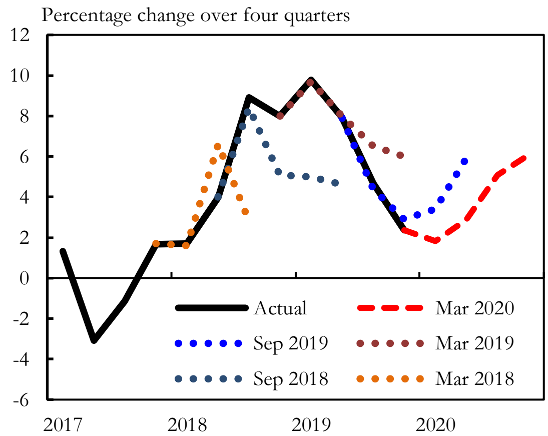
* Dotted lines indicate forecasts

Chart 6: Evolution of the bread & cereals inflation forecasts



* Dottted lines indicate forecasts

Chart 7: Evolution of the vegetables inflation forecasts



* Dottted lines indicate forecasts

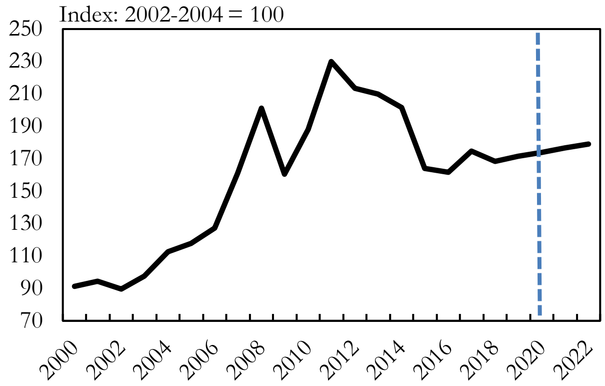
Sources: Stats SA and SARB

4. The global food price link

Moderating international agricultural food prices since 2011 (see chart 8), and a more recent de-coupling of international food from oil prices during 2018 (see Chart 9), have also made food forecasting especially difficult. This has contributed to the weakened relationship between global agricultural food prices and our domestic food prices since 2012. As the overall link has weakened (we show these metrics in the Appendix), we test the disaggregated domestic food components to see how well they are explained by their international food price counterparts. This is useful as over 70% of South Africa's food and NAB CPI is connected to the five agricultural components that make up the United Nations Food and Agriculture Organisation (UN FAO) food price index. Meat and cereals are the largest two components by weight, therefore being the most influential. Together they comprise over 60% of the UN FAO and almost as much of our domestic food CPI.[4]

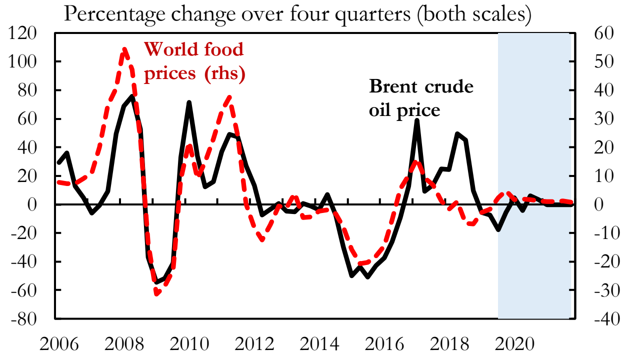
[4] In the International FAO index, meat and cereals weigh 35% and 27%. Dairy and vegetable oils weigh 17% and 14% respectively, while sugar weighs just 7%. Likewise, the largest South African CPI food components are also meat and cereals. Together they comprise 56% of our food (and half our food and NAB category).

Chart 8: Global agricultural food prices have moderated



Sources: UN FAO, World Bank and SARB

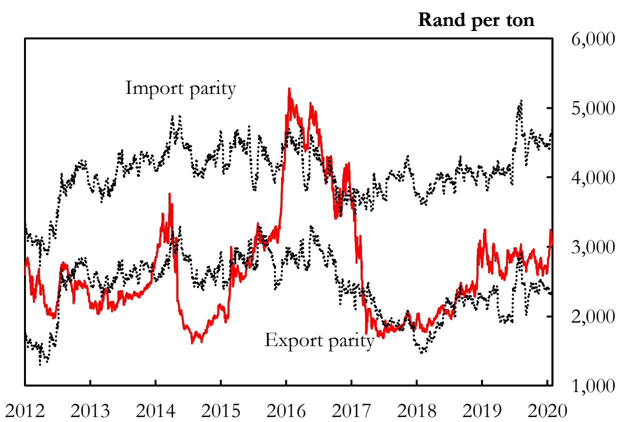
Chart 9: De-coupling of global food from oil prices



Sources: UN FAO and SARB

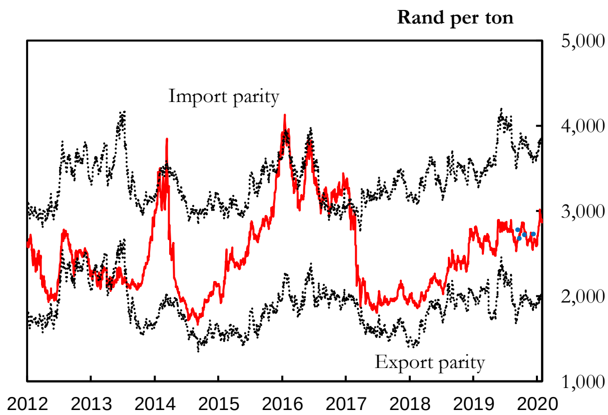
Domestic grains prices tend to broadly follow international prices, but this relationship is disrupted from time to time when domestic firms need to import grains following supply shortages. This occurred during the 2015/16 drought as domestic maize prices in particular became more vulnerable to international prices. Here, the maize shortage shifted South Africa from a net exporter to a net importer. Prices moved up from export to import parity, a more than doubling in the price – see Charts 10 and 11(the import and export parity wheat prices are shown in the Appendix). For yellow maize, this price was trading near export parity from mid-2012 to late 2013, before shifting up to import parity and back again over a six-month period. It immediately moved back to import parity from early 2015. Here it remained until the start of 2017, when it was clear the drought was over. It then traded above but near export parity, and is roughly midway between these two measures now. The white maize spot price has followed a similar trend since the drought commenced, but has been trading mostly around the export parity price since early 2017. This implies that while the relationship between global and domestic grains prices broke down during the post crisis period, should domestic maize prices remain near export parity then the relationship between global and domestic prices should improve again. As a result of these shifts, we rely on SAFEX grains futures prices when forecasting bread and cereals CPI prices. The SAFEX prices are assumed to account for both movements in international prices and potential shifts between import and export parity pricing.

Chart 10: White maize prices



Sources: Grain SA and SAFEX

Chart 11: Yellow maize price



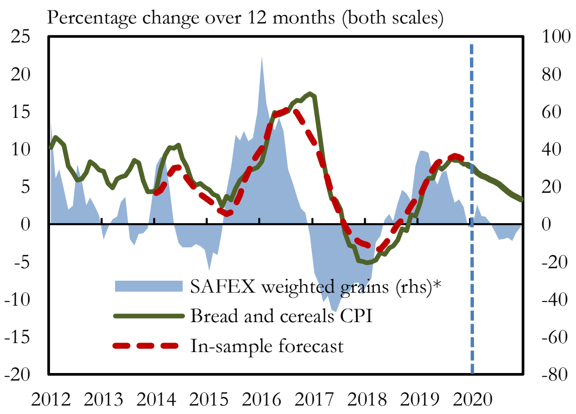
Sources: Grain SA and SAFEX

5. Food equations and the PPI

To enhance the analysis from our disaggregated inflation model, we have thus far managed to estimate three equations that perform quite well in-sample (see appendix) and can be used to forecast three food inflation components over the short to medium term. These equations only project one of the top five components, however, namely bread and cereals. We also have workable equations for sugar and vegetable oils prices. For bread and cereals and vegetable oils we use SAFEX spot prices in-sample and futures prices for the forecast. For sugar we use the international sugar price from the FAO and the rand US$ exchange rate.

The spot prices for both white and yellow maize have moved closer to export parity recently, but wheat prices remain close to import parity. When looking ahead the SAFEX futures prices for white and yellow maize for delivery over the next year and a half remain quite stable near current prices, reinforcing the expected stable maize supply environment. Bread and cereals inflation is projected to moderate over the medium term, from a peak of just over 8% three months from now to near 5% by December 2020 (Chart 12). Sunflower seed futures prices, our proxy for oils and fats CPI, fluctuate between R5300 and R5700 over the next year. Oils and fats CPI rise and then stabilise around 5% through to the end of 2020 (Chart 13).

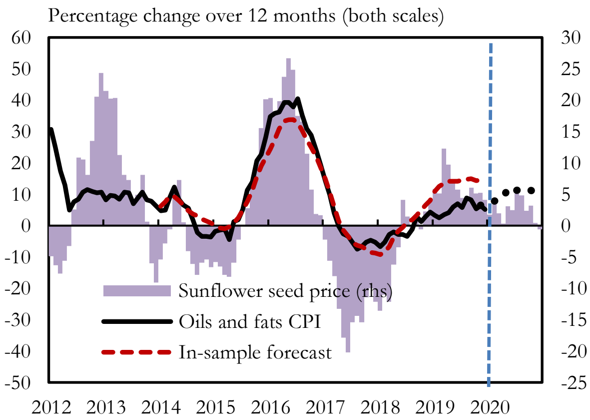
Chart 12: Bread and cereals CPI forecast



* Weighted white maize (55%), yellow maize (20%) and wheat (25%)
Grains are lagged by six months

Sources: Stats SA, SAFEX and SARB

Chart 13: Oils and fats CPI forecast

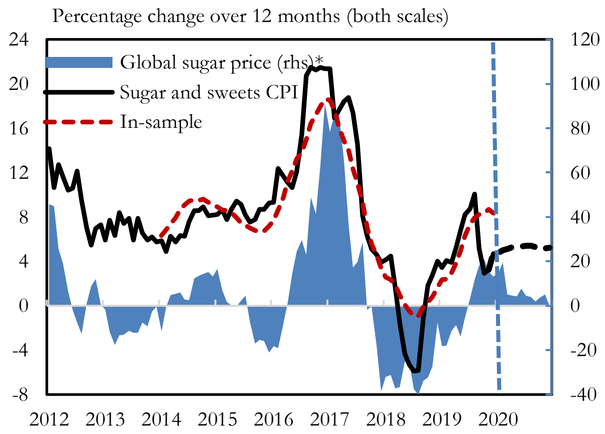


*Sunflower seed price is lagged with three months

Sources: Stats SA, SAFEX and SARB

Sugar and sweets CPI is expected to peak around 9% by October 2019 and then moderate to near 7% by December 2020 (see Chart 14). This is premised on a flat global sugar price and a moderate depreciation in the rand US$ exchange rate from current levels of R14.80 to the US$ to R15.20

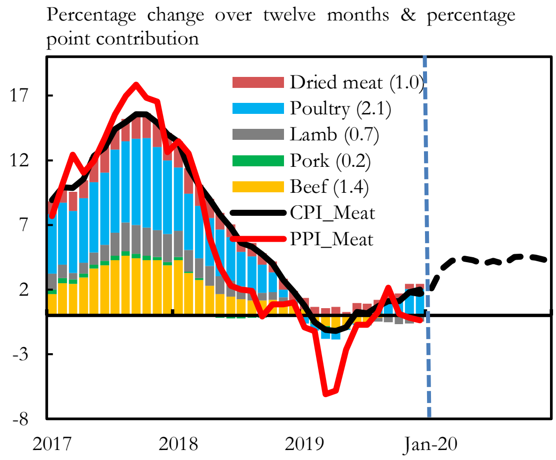
Chart 14: Sugar and sweets CPI forecast



* Global sugar price is lagged with six months

Sources: Stats SA, FAO and SARB

Chart 15: Meat CPI inflation forecast

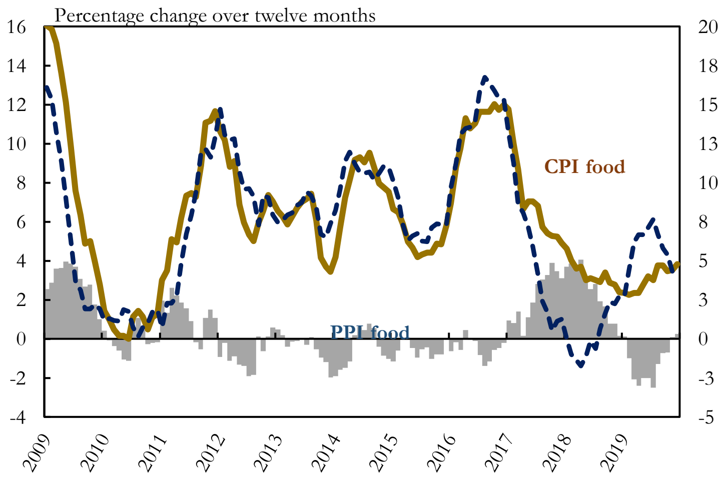


Sources: Stats SA and SARB

We use producer prices to give us an early indication of consumer prices in the case of meat inflation with the lag between meat PPI and CPI currently estimated to be two months. Meat PPI dipped deeper into deflationary territory than meat CPI did in early 2019 and has been in deflation for 10 of the past 14 months. Deflation in both relates to the foot-and-mouth disease outbreak in early 2019. By illustration, PPI outcomes for meat and meat products exited deflation in June 2019 having plumbed depths of -6.1% and -5.8% in the first two months of the year. The continued effects of this disease, which again took hold towards the end of 2019 is expected to persist in 2020 should continue to weigh on meat inflation this year. But, the low base created in 2019 should still see meat CPI rising gradually (Chart 15). For milk cheese and eggs CPI, the corresponding PPI component explains it well, but unfortunately, the relationship is contemporaneous and thus does not assist in the near-term projection.

In addition, we also check the overall relationship between domestic manufactured food PPI and food CPI (Chart 16). A close relationship with lags should improve our near-term consumer food inflation projections. This relationship improved in the period since 2012, relative to period from 2001 to 2011 – see appendix. The correlation coefficient strengthened for the later period, while the peak transmission time shortened. It should be noted though that more recently this relationship has worsened somewhat.

Chart 16: Domestic PPI and CPI food



Source: StatsSA

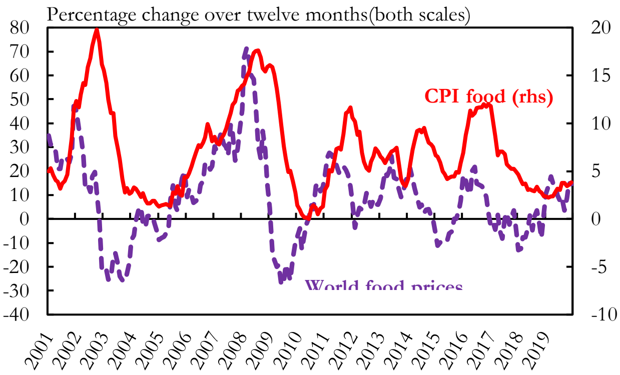
Conclusion

Our food CPI forecasts have been poor over recent years because of a range of factors, from severe drought to animal disease. This has contributed to the weakened relationship between global and domestic food prices. Exchange rate threshold effects and a fragile domestic economy are also playing a role in the large errors. We have had some success with our bread and cereals inflation projections, but this has occurred because grain futures prices have been reasonably stable for some time. This large weighted component is projected near 6% in 2020, but should still provide lower pressure on food inflation than the previous year. Early signs are that the foot-and-mouth disease that kept meat inflation in check in 2019 (near zero) will continue to do so this year, but base effects will still lift meat towards the target midpoint. One food specialist now expects food prices to remain muted at 4% in 2020. Our latest estimation for food and NAB inflation is in line with this projection at 4.4%, a reduction from 4.7% at the time of the January 2020 MPC meeting.

A. Appendix

Global agricultural prices and domestic food CPI, a weakened relationship

Chart A1: Global FAO and domestic food CPI

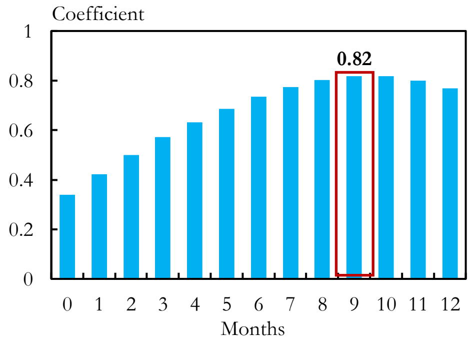


Sources: UN FAO and Stats SA

As the relationship weakens, so the predictive ability of global food prices (in rand) in explaining domestic food and NAB CPI deteriorates. We chose two sample periods to test the strength of the overall relationship between global agricultural food prices and South Africa's domestic CPI food inflation.[5] Global agricultural food prices no longer predict domestic CPI food inflation very well. Since 2012, a few years after the end of the global financial crisis, the peak correlation co-efficient has dropped to 0.54, from 0.82 over the 2001 to 2011 period. The peak lag length or how long it takes for international agricultural food prices to impact domestic food price inflation has shortened. It declined from nine to four months between the two periods – see Charts A2 and A3 below.

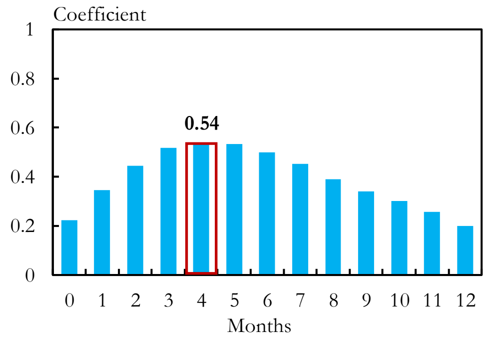
Charts A2 and A3: Relationship between the FAO global agricultural food prices and domestic CPI food prices

Period 1: January 2001 to December 2011



Sources: UN FAO and Stats SA

Period 2: January 2012 to December 2019



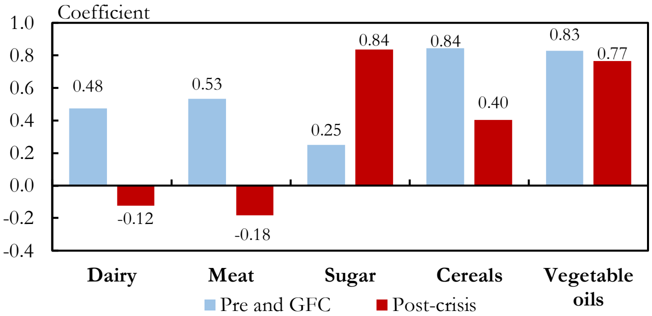
Sources: UN FAO and Stats SA

Of the five individual components of the FAO (they comprise almost 80% of domestic food CPI and 71% of food and NAB CPI), four relationships worsened from the earlier to the later sample period. Sugar is the one exception, but its weight is small. Vegetable oils, while weakening slightly, remains well explained by global prices over both periods. In part the weaker relationships are a result of the 2015/16 drought, when bread and

[5] The two periods are; before and during the global financial crisis (GFC) – from January 2001 to December 2011; and after the GFC – from January 2012 to June 2019.

cereals CPI was not driven by either international grain or energy prices (a relationship that weakened from 0.84 to 0.41). Here domestic grain prices moved from export to import parity and then back again. A similar pattern is observed with domestic PPI food equivalent components.

Chart A4: Relationship between the components of global agricultural and domestic CPI food prices



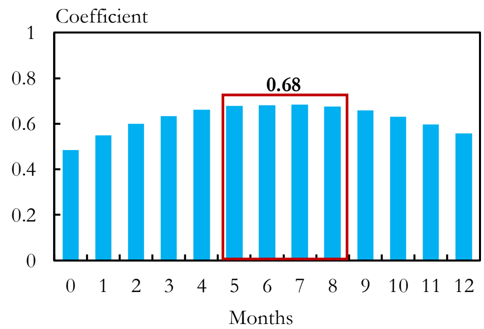
Sources: UN FAO and Stats SA

The relationship between domestic food PPI and CPI has strengthened

When testing how well domestic manufactured food PPI explains food CPI, we find that this relationship broadly improved after 2012 (although more recently this has weakened again), relative to the 2001 to end 2011 period.[6] When delving into the components we find that, with a lag, meat CPI can still be projected over the very near term using meat PPI, while the peak transmission time has shortened. The cross-correlation analysis shows an improvement from 0.68 to 0.80 (see Charts A6 and A7). While it took between five to eight months for PPI food to impact CPI food prices pre 2012, it now takes only two months. What should be noted though is that since mid-2018 this relationship has again started to look more tenuous and will need close monitoring. Part of the reason is that the five components discussed in this note only make up half of manufactured food PPI.

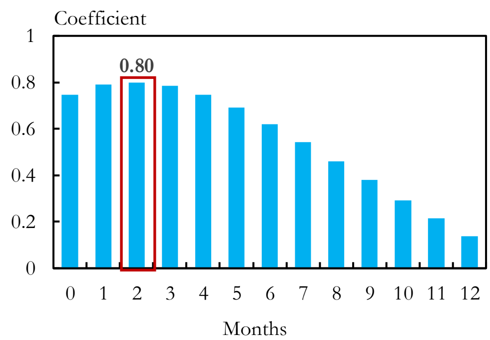
Charts A5 and A6: Relationship between domestic PPI and CPI food prices

Period 1: January 2001 to December 2011



Source: Stats SA

Period 2: January 2012 to December 2019

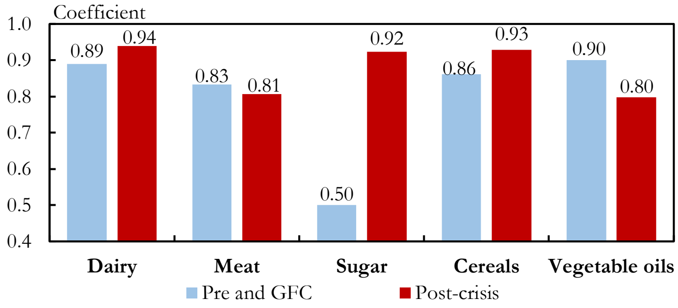


Source: Stats SA

On a disaggregated level, the five key domestic PPI food components (from the global FAO) display a strong relationship with their CPI food price counterparts for these two periods. In particular, the correlation coefficient for sugar has almost doubled. This suggests that where these domestic PPI food prices lag their CPI equivalents, they can be used as near term predictors.

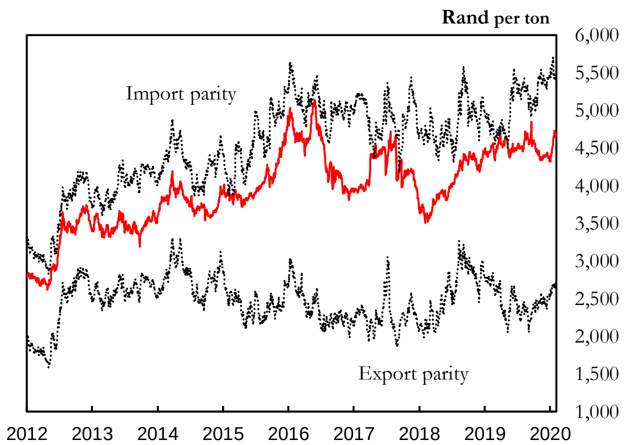
[6] while the peak transmission time has shortened

Chart A7: Relationship between the components of domestic PPI and CPI food prices



Source: Stats SA

Chart A8: Wheat import and export parity pricing



Sources: Grain SA and SAFEX

Equation A1: Bread and cereals equation

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: @PCY(CPI_BRDCER)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 02/04/20 Time: 14:27
Sample: 2010M01 2018M04
Included observations: 100
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
@PCY(CPI_BRDCER) = C(1) + C(2)*@PCY(CPI_BRDCER(-1)) + C(3) *@PCY(GRAINS(-2))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.562567	0.170302	3.303348	0.0013
C(2)	0.848515	0.036347	23.34464	0.0000
C(3)	0.037106	0.005245	7.074986	0.0000

R-squared	0.970342	Mean dependent var	5.796518
Adjusted R-squared	0.969730	S.D. dependent var	5.662051
S.E. of regression	0.985095	Akaike info criterion	2.837384
Sum squared resid	94.12999	Schwarz criterion	2.915539
Log likelihood	-138.8692	Hannan-Quinn criter.	2.869014
F-statistic	1586.796	Durbin-Watson stat	1.380532
Prob(F-statistic)	0.000000	Wald F-statistic	966.0904
Prob(Wald F-statistic)	0.000000		

Equation A2: Oils and fats equation

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: @PCY(CPI_OILSFATS)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 06/18/18 Time: 15:23
Sample: 2013M01 2018M04
Included observations: 64
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)
@PCY(CPI_OILSFATS) = C(1) + C(2)*@PCY(CPI_OILSFATS(-1)) + C(3) *@PCY(OILSUN(-1))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.546428	0.215807	2.532022	0.0139
C(2)	0.854027	0.024852	34.36388	0.0000
C(3)	0.059045	0.010420	5.666336	0.0000

R-squared	0.975471	Mean dependent var	4.803340
Adjusted R-squared	0.974666	S.D. dependent var	6.956457
S.E. of regression	1.107229	Akaike info criterion	3.087338
Sum squared resid	74.78328	Schwarz criterion	3.188536
Log likelihood	-95.79483	Hannan-Quinn criter.	3.127205
F-statistic	1212.904	Durbin-Watson stat	1.801695
Prob(F-statistic)	0.000000	Wald F-statistic	2090.054
Prob(Wald F-statistic)	0.000000		

Equation A3: Sugar, sweets and desserts equation

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: @PCY(CPI_SUGARSWDES)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 06/18/18 Time: 15:22
Sample: 2010M01 2018M04
Included observations: 100
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)
@PCY(CPI_SUGARSWDES) =C(1) + C(2)*@PCY(CPI_SUGARSWDES(-1)) + C(3)*@PCY(SUGWRLDDEC16(-3)) + C(4) *@PCY(EXDOLLDDEC16(-3))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.834030	0.431543	1.932671	0.0562
C(2)	0.848737	0.046746	18.15634	0.0000
C(3)	0.028914	0.008967	3.224418	0.0017
C(4)	0.056892	0.014739	3.860030	0.0002

R-squared	0.902543	Mean dependent var	9.242872
Adjusted R-squared	0.899497	S.D. dependent var	4.683541
S.E. of regression	1.484785	Akaike info criterion	3.667595
Sum squared resid	211.6402	Schwarz criterion	3.771801
Log likelihood	-179.3797	Hannan-Quinn criter.	3.709769
F-statistic	296.3489	Durbin-Watson stat	1.765181
Prob(F-statistic)	0.000000	Wald F-statistic	339.0889
Prob(Wald F-statistic)	0.000000		

Table A1: Lag length from global agricultural food prices to domestic food prices (Pre-Crisis)

	FAO to PPI	**PPI to CPI**	**FAO to CPI**
Dairy	6 – 12 months*	0 – 2 months**	6 – 12 months*
Meat	7 – 12 months*	0 – 2 months**	Negative relationship
Cereals	2 – 6 months*	0 – 2 months**	3 – 12 months*
Sugar	0 – 3 months**	0 – 3 months**	1 – 5 months**
Vegetable oils	1 - 2 months**	0 – 2 months**	0 – 2 months**

*Very weak relationship of below 0.5

**Strong relationship

Table A2: Lag length from global agricultural food prices to domestic food prices (Post-Crisis)

	FAO to PPI	PPI to CPI	FAO to CPI
Dairy	3 – 7 months*	0 – 3 months**	6 – 12 months*
Meat	2 – 8 months*	0 – 3 months**	4 – 10 months*
Cereals	1 – 7 months**	1 – 4 months**	1 – 8 months**
Sugar	6 – 12 months*	1 – 9 months*	2 – 6 months**
Vegetable oils	1 - 3 months**	0 – 3 months**	1 – 6 months**

*Weak relationship of below 0.5

**Strong relationship