We next look to understand whether interdependence between commodities over the four phases. To that end we classify our twenty-four US based commodities into three groups, namely Agricultural, Energy and US Metals while the six UK based metals form the GB Metals group. We first examine the average of weekly pairwise correlations between commodities in each group over the four periods as well as for the entire sample, with the results reported in Table 3. For the entire sample of thirty commodities the average pairwise correlation jumps from 0.07 in the first period to 0.16 over financialization, increasing further to 0.28 over the financial crisis period before falling back to 0.12 over the present period. These findings indicate higher interdependence within the full cross section of commodities starting with the financialization period and extending into the financial crisis period, consistent with the empirical findings in Fry-McKibbin and McKinnon (2023) and Mayer et al (2017). The increased average pairwise correlations over the financialization period is consistent with the theoretical model of Basak and Pavlova (2016) while the increase over the financial crisis period is consistent with greater interdependence between equity and commodity markets over this period as documented in Silvennoinen and Thorp (2013). The substantial decrease in correlations over the present period does not appear to have been widely noted. The subsector analysis sheds light on the driving force behind these changes, with the US Metals subsector seeing the sharpest increase in pairwise correlations going from 0.22 over the first period to 0.56 over financialization increasing slightly to 0.59 over the crisis period. The three other subsectors see a much smaller percentage increase from the first period to financialization and the financial crisis, although there is a sharp increase for GB Metals over the financial crisis period. These findings thus suggest that the US Metals subsector was the driving force behind increased average pairwise correlations during financialization, a new observation to the best of our knowledge.

We next examine the pattern of weekly correlations during phases of backwardation and contango in Table 4. The results show that the pattern of correlations is very similar across these two phases for all the subsectors over the first three periods. This finding indicates that increased commodity interdependence over financialization was not a phase driven phenomenon in the same way that individual commodity returns are as demonstrated in Table 2. Over the present period there appears to be some evidence that metal correlations are higher during periods of contango. In Table 5 we report the yearly correlations to ascertain if there are any clear break points. For the full sample of commodities, we see that average pairwise correlations increase from 0.08 to 0.12 from 2003 to 2004, and this seems to be driven by US Metals average pairwise correlations more than doubling from 0.22 to 0.49. This suggests 2004 as the onset of financialization as noted in several studies (Baker 2020, Tang and Xiong 2012) and our contribution is to observe that the US Metals subsector seems to have played a major role in this. The US Metals correlations continue to increase, peaking at 0.63 in 2006 and remaining above 0.54 from 2005 with no discernible increase over the financial crisis period. In contrast, average pairwise correlations for the Agricultural subsector increases sharply from 2007 to 2008, from 0.11 to 0.30 with more modest increases for Energy and GB Metals. Thus, the change in US Metals correlations seems to have been driven entirely by financialization while the onset of the financial crisis seems to have had a stronger effect on the other subsectors.

We next consider an asset pricing perspective which builds on the preceding analysis. We construct an equally weighted portfolio of the twenty-four US commodities as our factor, a proxy for the commodity market portfolio, and compute weekly betas over each of the four periods for each individual commodity and then average these for each subsector. The logic of this exercise is to examine cross correlations across sectors, that is an increase in a commodity’s correlation with other commodities should lead to an increase in its beta with respect to the equally weighted factor, as the numerator of the beta is driven by covariances while the denominator will be driven by the individual commodity variances. The results are reported in Table 6, and we see that the average beta for the US Metals subsector jumps sharply from 0.63 in the first period to 1.12 over financialization and remaining at that level over the financial crisis and dropping to 0.91 over the present period. The results for the UK Metals, which are all base metals, are even more dramatic, as these had an average beta in the first period of 0.27 suggesting a low level of correlation with US commodities. Over the financialization period the average beta increases to 0.85 which is higher than that for the Agricultural subsector and increases to 1.18 over the financial crisis period higher than that for the US Metals. In contrast the betas for the Energy subsector are lower over the financialization and financial crisis period than for the first period. We then examine the average R2 of the equally weighted market portfolio for the full cross section and the various subsectors, including periods of backwardation and contango in each sub-period, and results are reported in Table 7. A similar pattern obtains for the pricing performance over the entire sub-period with the average R2 for the full cross section (including GB metals) rising to around 20% during financialization compared to around 10% in the prior period, increasing to 31% over the crisis period and falling to 15% during the present. The sharpest sub-sector increase is for the metals sub-sector, with the US metals average R2 rising to almost 31% over financialization from 7.5% in the previous period. The US based market factor had virtually no explanatory power for the GB metal sub-sector in the first period, with an average R2 of less than 2%, but this increases to almost 12% during financialization, and remains at around 11% during the present. For both the US and GB metals sub-sector the pricing performance during the present is considerably better during periods of contango, while in previous periods pricing performance during backwardation and contango were similar which indicate some recent changes in the correlation structure of metals, particularly industrial metals[[1]](#footnote-1).

These findings provide further evidence that the interdependence effects of financialization seems to have been strongest for the entire metals subsector and seem to have a lesser effect on the other subsectors.

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1. For US base metals, the R2 is around 28% during contango in the present period compared to 10% during backwardation while for precious metals was 22% during contango compared to 12% during backwardation. For the GB metals which are all base metals, it was 14% during contango compared to around 7% during backwardation while the corresponding numbers for financialization were 11% and 13% respectively. [↑](#footnote-ref-1)