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COMMITTEE ON COMMODITY PROBLEMS

INTERGOVERNMENTAL GROUP ON TEA

TWENTY-FOURTH SESSION

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INTERNATIONAL TEA PRICES: INSIGHTS INTO THE NATURE OF PRICE VOLATILITY

Executive Summary

International tea prices are characterized by relatively elevated volatility, which constitutes a major challenge for producers and other market operators. The objective of this document is to identify and examine the nature, extent and implications of volatile tea prices, highlighting possible policy actions. We identify four major sources of price movements based on economic literature and the specific nature of the tea market. These are: 1) global economic activity, as a proxy for shifts in aggregate demand; 2) changes in net supply of tea, to account for tea-specific demand and supply shocks; 3) the value of the United States of America dollar (USD) with respect to that of other major international currencies; and 4) oil prices, as a proxy for energy costs. The applied empirical framework splits the effects of these four factors and estimates the extent of their contribution in explaining tea price booms and busts. Results indicate that the bulk of the price movements in the tea market is attributed to shocks that are specific to the sector, that is changes in the fundamentals of tea demand and supply. It should be noted, however, that the impact of the economic activity on tea prices was greatest in the first three months of 2020, coinciding with the onset of the COVID-19 pandemic and the resulting lockdowns and global economic downturn. Clearly, an effective way to reduce volatility is to bring about a permanently improved balance between supply and demand.

Suggested action by the Group

The Group is invited to:

- Take note of the main drivers of volatility in international tea markets, as well as their impact and relative contribution.
- Discuss and provide guidance on how to reduce the negative effects of price volatility, while strengthening the long-term productivity and resilience of the tea sector.

Queries on the substantive content of the document may be addressed to:

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I. INTRODUCTION

1. International tea prices, like those of most agricultural commodities, are marked by relatively elevated volatility. The volatile nature of prices has implications not only for investment decisions, but also for household incomes, food security and government revenues. Many producing and exporting countries rely on revenues from tea exports to secure foreign exchange that is necessary to pay for the import of services and goods, such as basic foodstuffs. In addition, the tea sector provides productive jobs and income to many of the poorest rural areas in the world. One of the key characteristics of tea is that smallholders are estimated to be responsible for 60 percent of world tea production. In the four main producing countries (China, India, Kenya and Sri Lanka), tea crop production employs over 13 million workers, of which around 9 million are smallholders. Tea exports account for a sizeable share of export earnings of many developing countries, contributing to the achievement of the 2030 Agenda and the Sustainable Development Goals (SDGs) by creating employment, generating income and alleviating poverty.

2. After reaching low levels in early 2000, world tea prices, in real terms, increased steadily to reach a peak in 2010, before beginning a gradual and long decline interrupted only by a short-lived price spike in 2017. In 2021, world tea nominal prices, as measured by the FAO Tea Composite Price, are down 4.4 percent from last year and have lost 22 percent since 2017. In real terms, prices are less than 28 percent of their 2017 level, and for many producers, they are lower than production costs. Recurrent swings in tea prices can represent a source of macroeconomic instability, creating challenges to the livelihood of millions of smallholder tea producers and risks reversing the gains made in living standards.

3. The objective of this document is to examine the nature, extent and implications of volatile tea prices, highlighting possible policy actions. We identify four major sources of price movements based on economic literature and the specific nature of the tea market. These are: 1) global economic activity, as a proxy for shifts in aggregate demand; 2) changes in net supply of tea, to account for tea-specific demand and supply shocks; 3) the value of the United States of America dollar (USD) with respect to that of other major international currencies; and 4) oil prices, as a proxy for energy costs. A Structural Vector Autoregressive (SVAR) model is used to separate the effects of these drivers and estimate the extent of their respective contributions in explaining price changes. As customary with these approaches, there is an identification problem that needs to be addressed, and the literature on this subject offers several options. In this study, identification is achieved by exploiting the existence of different volatility regimes, as described in Rigobon (2003). Results indicate that the bulk of the price movements is due to shocks that are specific to changes in tea demand and supply.

4. The next section of this document examines the source of price variability and its implications. Then, we elaborate on the applied methodology and data, briefly identifying some aspects associated with the use of SVAR. The following two sections present and discuss the main results of the analysis and draw some policy implications, while the final sections provide some concluding remarks.

Figure 1. World tea prices in real terms, FAO Tea Composite Price (US cents/Kg)

Source: FAO IGG/Tea. The price series was deflated using the United States consumer price index.

II. THE NATURE OF PRICE MOVEMENTS

5. Volatility is a common feature of international commodity prices, and tea is no exception. Research on this topic has tended to examine the sources of volatility and their relative weights in affecting price movements. Factors that are responsible for the commodity price shocks can be grouped into two broad categories. The first category relates to commodity-specific factors, which include shocks to demand and supply, often referred to as the fundamentals. For example, weather related events such as droughts or floods can cause substantial damage to crops and lead to a reduction in production. In this category demand shocks due to sudden shifts in the consumption of a crop can also affect prices significantly. A sudden increase in the demand for inventory can also explain commodity price spikes. For example, Janzen *et al.* (2018) found that the surge in cotton prices in 2008 was largely due to an increase in inventory demand for cotton. When market participants expect futures prices to exceed the present price plus physical storage costs, the opportunity cost of capital and a convenience yield, then demand for inventory increases which puts an upward pressure on current prices (Kaldor, 1976; Working, 1949).

6. The second broad category responsible for movements in commodity prices includes macroeconomic factors that have cross sectoral impacts. For example, changes in per capita income, population growth rates, interest rates and currency exchange rates can be responsible for co-movements of prices across commodity sectors. Headey and Fan (2008) explain that commodity specific factors, such as weather related shocks, are less likely to increase international prices of commodities than factors that are common across commodities, such as growing aggregate demand in emerging markets, a depreciation of the USD, a rise in energy prices or an expansion in monetary policy. An important body of research attributes the steady increase in commodity prices during 2002-2008 to common factors that are macroeconomic in nature. A third factor that has been identified as a potential source of price fluctuations is speculation that is linked with financial markets. This has grown in importance with the "financialization" of commodities. Commodities are increasingly being included in financial portfolios as part of a diversification strategy. Whether this financial speculation shapes the direction of prices is an empirical question that still remains controversial. Research is split on the question, and there are supporting empirical arguments on both sides.

7. A number of reasons have been put forward to explain the steady decline in international tea prices, particularly in the last decade. These cover the relatively robust expansion of production capacity in some of the major producing countries, slow growth of global consumption especially in developed countries, technological advances in tea processing, excess market power by the major tea

traders and the depreciation of the currencies of major exporters against the US dollar. Frequent positive production shocks have exerted significant downward pressure on world tea prices, further exacerbated by the inherent economic and physical characteristics of tea. The demand for tea is inelastic, meaning that substantial shifts in consumption can occur only under the condition of significant changes in prices. Likewise, supply is relatively inelastic pertaining to the perennial nature of the crop (with a global average supply elasticity estimated at 0.25). Investing in a tea orchard is essentially a long-term commitment such that short term movements in prices do not have significant impact on supply. Short-term strategies in response to low prices are limited to taking less care of the trees and cutting back on harvesting tea leaves. Yet, these actions can have much broader implications such as an increase in rural unemployment, a decline in incomes and an upturn in migration out of rural areas.

8. The effects of declining and volatile tea prices on exporting countries depend on the degree of dependency on the crop. While many countries have reduced export dependency over the years, others still depend on tea export earnings for socio-economic development. For example, tea exports account for 70 percent of total agricultural exports in Sri Lanka, 35 percent in Kenya, 27 percent in Burundi and 7 percent in Malawi and Uganda. The impact of persistently low tea prices can have wide-ranging and lasting impacts on rural communities, through multiplier effects on employment, income and the various upstream and downstream sectors associated with the tea value chain. In particular, declining prices often push smallholders to adopt coping strategies that may involve cutting expenditure on essential items such as education, health and meals per day. Falling tea export earnings can also have notable broad-based macroeconomic consequences. These take the form of cuts in governments' income tax receipts and a reduction in foreign currency earnings. For many poor tea exporting countries, foreign currency earnings help manage current account deficits without having to increase national debts to unsustainable levels. The linkages between fiscal position and export earnings in commodity-dependent countries remain quite robust in several contexts (IMF, 2008).

9. The potential implications of tea price shocks for exporting countries highlight the importance of identifying the sources of price movements and their relative strengths. The next section describes the methodology applied to disentangle the drivers of tea prices and the data used for the analysis.

III. METHODOLOGY AND VARIABLE SELECTIONS

10. The SVAR model has a wide application in the economic literature of price volatility. For example, using a partial identification scheme of a SVAR model, Carter *et al*. (2017) explored the contribution of ethanol mandates in the United States of America on maize prices. They found that maize prices would have been lower by 30 percent between 2006 and 2014 without the increase in demand generated by the mandate. Likewise, Hao *et al*. (2017) looked at the linkages between the ethanol market and maize prices in developing countries using a panel SVAR analysis. On the other hand, Stuermer (2018) examined the long-run evidence on the dynamic effects of supply and demand shocks on commodity prices. The author identified the structural shocks based on long-run restrictions placed on the SVAR system. To investigate the role of speculative trading in the global crude oil market Kilian and Murphy (2014) also applied a SVAR that allowed for a speculative component associated with demand for inventory. The results showed that the 2003-2008 price surge was due mainly to an increase in global oil consumption driven by business cycle.

11. Other uses of SVAR include Bruno *et al*. (2017), who looked at the contribution of financial speculation to commodity markets. They found that the impact of financial speculation on cross-market return linkages is shorter-lived and not statistically significant. Similarly, Lombardi and Van Robays (2011) used a SVAR model identified through sign restrictions to disentangle non-fundamental financial shocks from supply and demand fundamental shocks to oil. Results highlighted that financial investors in the futures markets can destabilize oil prices, but only in the short-run. Similarly, Juvenal and Petrella (2015), applying a SVAR approach, argued that the oil price increase between 2004 and 2008 was mainly driven by the strength of global demand, however, they found that the financialization of commodity markets also played a role. On the other hand, Janzen *et al.* (2018)

found little evidence of the role of financial speculation in driving cotton prices. Rather, their results from a SVAR model showed that the 2008 price spike was mostly due to precautionary demand for cotton, while the 2011 price surge was caused by a net supply shortfall. Also, Qiu *et al.* (2012) found that the market fundamentals of supply and demand were the main drivers of food price volatility, with increased biofuel production causing short-term food price increases but not long-term price shifts. Based on a structural VAR framework, Alam and Gilbert (2017) showed that monetary policy, global economic conditions, as well as the value of the USD, played an important role in the dynamics of agricultural commodity prices.

12. The wide application of the SVAR approach demonstrates its ability to provide useful insights into the issues of agriculture and commodity markets. The popular Vector Autoregression (VAR) model is in fact the restrictive form of the SVAR (Kilian and Lütkepohl, 2017). The VAR model was introduced by Sims (1980) as an alternative to simultaneous equation models to address the endogeneity bias that often results from estimating models that display contemporaneous linkages between variables. The SVAR model can be written as

$$\boldsymbol{A(L)y_t \equiv \left(A_0 - A_1 L - A_2 L^2 - \ldots A_P L^P\right) y_t = u_t} \quad (1)$$

where y_t is a K x 1 vector of selected variables, $A(L)$ is the autoregressive polynomial of order p, and u_t denotes structural shocks that are white noise and uncorrelated with one another. The objective is to identify the structural shocks related to the selected variables and assess their relative effects on tea prices. Because these shocks are not observable, they need to be related to the reduced form VAR model by multiplying through (1) by A_0^{-1}:

$$\boldsymbol{B(L)y_t \equiv \left(I - B_1 L - B_2 L^2 - \ldots B_P L^P\right) y_t = \epsilon_t}, \quad (2)$$

with $\boldsymbol{\epsilon_t = A_0^{-1} u_t}$ (3)

13. Equation (3) shows that the residuals of the reduced form VAR are a weighted sum of the structural residuals of the SVAR representation. Unless some specific assumptions were made, equation (3) cannot be used to identify the structural shocks, as the order condition would not be satisfied. That is, we have more parameters to estimate than available equations. Normalization and recursion are the two most common assumptions to identify structural shocks in (3). While normalization refers to assigning a unit value to the diagonal of matrix A_0, recursion implies ordering the variables according to their presumed contemporaneous effects on one another. Often the case, this ordering approach can be difficult to justify on the basis of theory, leading Kilian (2013) to propose a number of alternative options, including the use of sign restrictions. Rigobon (2003), on the other hand, used an estimator to explore the prevalence of different volatility regimes in the structural shocks. This approach, which is referred to as the Identification through Heteroskedasticity (ItH), is well suited in the context of commodity markets that are marked by high and recurrent volatility. Starting from equation (3), the ItH relates the second moment of the reduced-form to that of the structural shocks and can be specified as follows:

$$\boldsymbol{A_0 \Omega^r A_0' = \sum_u^r}, \quad (4)$$

14. where Ω^r is the variance-covariance of the reduced form structural shocks, $\sum_u^r$ the variance-covariance of the structural residuals and $A_0$the matrix capturing the contemporaneous effects. The method works by identifying various volatility regimes that underpin the observed prices and computing the reduced-form variance-covariance matrix associated with each of these regimes. The subscript r in (4) refers to parameters that vary between regimes. In practice, two regimes, say a volatile and a tranquil period, are sufficient for the system to be identified. For example, in the case of two variables, there will be 6 equations for 6 parameters to be identified.

15. Based on the discussion in the previous section, four variables were selected to be included in y_t. These are: 1) global economic activity; 2) international crude oil prices; 3) the value of the USD with respect to other major currencies; and 4) international tea prices. The Kilian (2009) index is used

as a measure of global economic activity. The index is computed from dry cargo shipping rates and adjusted for trend, with high values capturing upward shifts in global demand for goods. The crude oil price series is the logarithm of the monthly average of the West Texas Intermediate (WTI) futures prices adjusted for trend and deflated by the United States consumer price index (CPI). For the purpose of the analysis, crude oil prices capture cost of production of made tea. The value of the USD is measured against the currency value of a broad group of major trading partners of the United States of America. The price series is extracted from the Federal Reserve Economic Data (FRED) database. Given that the bulk of the international tea trade takes place in USD, movements in the value of that currency have an effect on the traded volumes. For example, a significant appreciation of the USD will tend to limit tea import demand. The FAO tea composite price was used to capture changes in international tea prices. The composite price is a weighted average of the monthly price realizations in the major tea auction markets. The logarithm of the composite price series is deflated using the CPI and adjusted for trend. The time series are sampled at the monthly frequency and cover the time period from January 1989 to October 2021. The model is coded in R and the svars package is used for the estimation.

IV. RESULTS OF THE ESTIMATION

16. The parameters of the SVAR model are estimated relying on normalization, recursion and ItH. The recursion is based on an order which lists variables in terms of their contemporaneous effects on other variables. It is first assumed that shocks in the tea market do not spill over contemporaneously into the other variables. This means that the last column of matrix A_0 has zero values throughout, with the exception of the last entry. In this set up, shocks in the global economy, the crude oil market and the value of the USD transmit contemporaneously to the international tea prices.

17. One assumption that can be difficult to justify is to consider that there are no simultaneous effects between the value of the USD and the crude oil market. That is, in the second row of matrix A_0, the parameter corresponding to the exchange rate cannot be restricted to zero. The same argument applies to the third row of matrix A_0 with respect to the parameter corresponding to the crude oil variable. Likewise, it is unlikely that shocks in the crude oil market do not impact economic activity. If these parameters were left unrestricted, then equation (4) would be unidentified. This is where the ItH approach becomes handy and helpful in identifying the system, but it requires, as described above, the identification of volatility regimes.

18. A casual inspection of figure 1 suggests that tea prices may be underpinned by different volatility periods, particularly before and after mid-2000. After running the VAR model that includes the selected four variables, the residuals of the tea price equation are extracted and tested for the presence of structural breaks. The test is based on the Quandt likelihood ratio (QLR) statistic, which works by selecting the maximum of all the Chow F-statistics over the range of possible breaks in the sample. Results of the test on the residuals reveal the presence of one statistically significant structural break identified in December 2007. Therefore, the sample is divided into two regimes, corresponding to the period before and after the structural break, and a variance-covariance matrix of the reduced form is computed for each of these two periods. The ItH also assumes that the parameters of matrix A_0 remain unchanged in both regimes. With the assumptions of normalization, recursion and the use of the ItH, the system (4) becomes identified as the order condition is met.

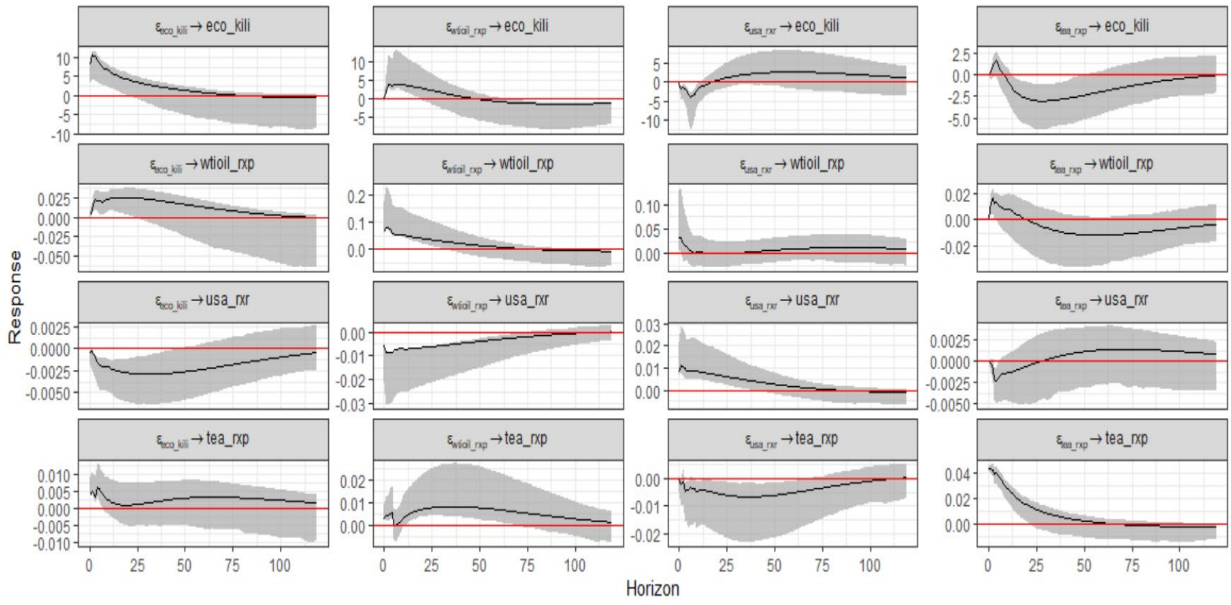
19. The model is solved using the maximum likelihood approach, enabling the identification of a set of orthogonal structural shocks for each of the selected variables. The price equation explicitly includes three variables controlling for real economic activity, crude oil prices and the changes in the value of the USD, with the residuals encompassing supply and demand shocks, which we referred to as net supply. Figure 2 displays the calculated impulse response functions, with the associated confidence intervals obtained using Hall's bootstrap method (Hall, 1992). Estimation results show that the selected variables react most to their own shocks, and these impacts tend to be statistically significant and relatively long-lived. The bottom-right corner of figure 2 illustrates the effects of a net supply shock on tea prices (equivalent to a supply disruption due, for example, to adverse weather

conditions). The effect is found strongest at first impact and then declines gradually over time to reach zero after about five years. By symmetry, a surge in supply of tea can therefore have lasting negative effects on prices.

20. The effect of real economic activity shocks on tea prices is relatively small, long-lived and statistically significant, on average, for a few months. Likewise, shocks originating from the crude oil market are small and largest in the first months, but then, their effect declines over time and is, on average, not statistically significant. The impact of shocks in the value of the USD are also relatively small but long-lasting. Overall, the direction of these various shocks are in line with expectations, with shocks in real economic activity, crude oil and USD triggering responses in tea prices, but the largest impact is accounted for by tea-specific demand and supply shocks.

21. As expected, price shocks in the world tea market do not lead to statistically significant effects on crude oil, USD and real economic activity. However, if the analysis were to be carried out at a less aggregated level, by selecting a country where tea exports represent an important share of gross domestic product (GDP), then the effects of shocks on the tea market would likely be widespread, altering key variables including real GDP, the exchange rate and inflation.

Figure 2. Impulse response functions

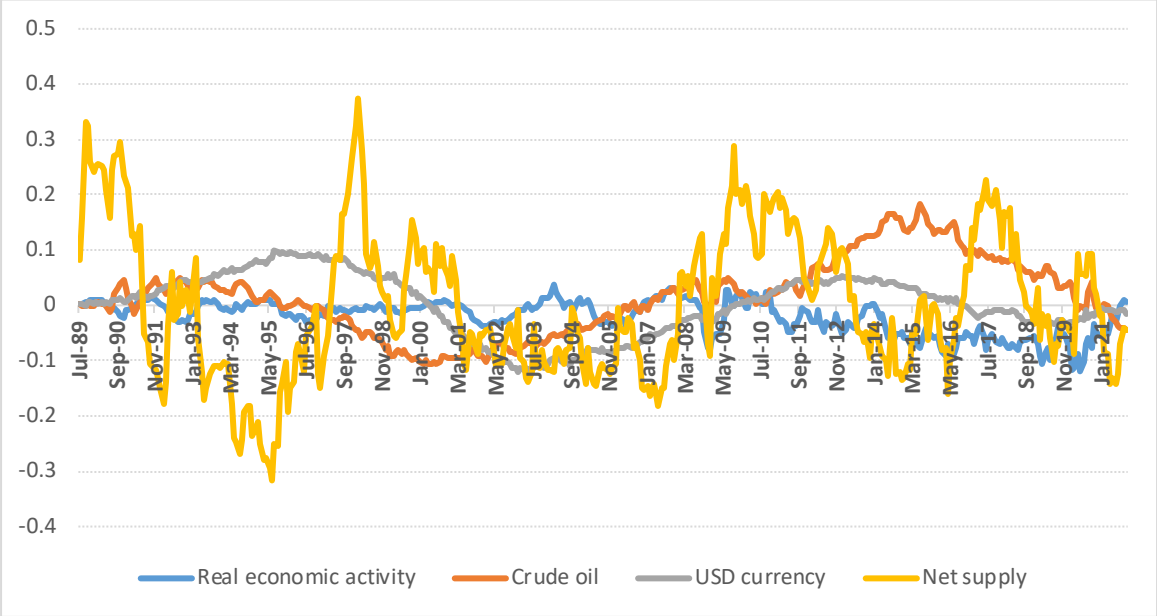


Note: Impulse response functions were generated using the SVAR model, with 95 percent confidence bands based on 1000 bootstrap replications. The structural shocks were identified using the ItH approach. Variables tea_rxp, eco_kili, wtioil_xp and usa_rxr denote real tea prices, real economic activity measured by the Kilian index (Kilian, 2009), WTI crude oil prices in real terms and the USD real exchange rate, respectively.

22. The impulse response analysis is an effective method to examine the results of a SVAR estimation, but it does not reveal the magnitude of the various shocks at each point in time. For this, a historical decomposition of tea price variations was carried out using the estimated orthogonal shocks from the SVAR estimation, considering that the reduced form residuals are a weighted sum of the structural shocks. The results of this decomposition exercise show that, over the sample period, the bulk of the movements in tea prices is caused by shocks specific to the tea market itself. As figure 3 illustrates, swings in net supply have marked dents on price fluctuations. For example, between 1990 and 1995, shocks to the net supply of tea were the main factors underpinning the sustained decline in tea prices. Likewise, the price decline between 1998 and 2002, and 2009 and mid-2016 were mostly caused by net supply shocks, driven by robust expansions in tea production.

23. The contribution of economic shocks to variations in tea prices are relatively small in comparison to the other variables. Even during 2000 and 2008, when commodity prices were rising, prompted by a robust growth in emerging markets, the effect of the real economic activity on tea prices was relatively muted. However, the impact of the variable on tea prices was greatest in the first three months of 2020, coinciding with the onset of the COVID-19 pandemic and the resulting lockdowns and global economic recession. Without this economic shock, tea prices would have been higher, on average, by 10.3 percent. The results of the decomposition show that swings in oil prices have a small but long lasting effect on tea prices. During the first half of the last decade, the contribution of crude oil prices to tea price volatility was the largest, sustained by rising global oil quotations. For example, during the first six months of 2014, when crude oil prices fluctuated above USD 100 per barrel, international prices of tea would have been lower by 14.3 percent, on average, in the absence of shocks in the oil market. Changes in the value of the USD are periodically relevant but not to the extent of driving price volatility in tea markets. Overall , the empirical evidence from our decomposition analysis seems to point to a well-functioning market structure to the extent that tea price movements reflect, for the major part, the conditions of the tea market fundamentals of supply and demand.

Figure 3. Structural decomposition of shocks to tea prices using the SVAR model



V. WHAT LESSONS CAN WE DRAW FROM THE ANALYSIS OF TEA PRICE VOLATILITY?

24. The findings that most tea price booms and busts stem from shocks to the net supply of tea suggests that an effective way to reduce volatility is to bring about a permanently improved balance between supply and demand. Since demand for tea is relatively stable, the source of large swings in net supply is essentially linked with production. Since 2011, global area devoted to tea has been increasing by 5 percent per year, without a concomitant rise in demand. As a result, international tea prices have been falling in real terms. The issue of declining and volatile prices is not a new phenomenon nor is it a specific feature of the tea market. However, in the case of tea and other cash crops, the proposed policies often involved an attempt to control prices in one way or another. A case in point are the International Commodity Agreements (ICAs) with "economic clauses", which were endorsed to address the market volatility that characterized international tropical commodity markets. These agreements ultimately fell short of achieving their intended objectives because of the difficulty in reversing, or slowing, the secular downward trend in prices. Interventions in sugar markets ended in 1984, while those for coffee and cocoa ceased in 1989 and 1993, respectively. Supply arrangements for jute and rubber were maintained up until 2000. The effectiveness of the ICAs rested on the national

mechanisms regulating domestic production and the delivery of supplies to the international market. The burden of stabilization was borne by these institutions (e.g. marketing boards). However, with declining economic resources, failing governance and the dismantlement of these bodies, there was little quantitative leverage that could be used to maintain prices within certain ranges; indeed, they were also generally negotiated at levels that were not necessarily competitive albeit being remunerative for producers.

25. In 2000, in the midst of a coffee crisis, the Association of Coffee Producing Countries (ACPC) promoted a coffee export-retention scheme, where 20 percent of coffee exports would be withheld from the market. In the end, only a few countries actually retained any coffee, and the agreement fell apart. In a sense, this reflects the challenge of implementing producers-only agreements, as these require strong commitments and the policing of free-riders – those supplying outside the agreement. Other producers-only schemes, such as those covering cocoa and sugar, also fell short of creating and maintaining a price floor. As the above example from the coffee sector shows, price control schemes are not the cure but part of exacerbating the problem of volatility.

26. Addressing the issue of declining and volatile tea real prices requires coordinated global actions. What is needed is not market intervention, but rather market cooperation – mostly cooperation among tea exporters and importers to ensure that the international tea market expands reasonably and protects the livelihood of millions of smallholder tea producers, who operate on limited land holdings. Market cooperation also includes sharing the most accurate and reliable market intelligence on tea markets, covering both the short- and medium-term outlooks. Plans for production expansion beyond those driven by the market should be made available. Global cooperation also means developing, implementing and monitoring globally coordinated promotional activities that have the commitment of exporters and importers. For example, several generic promotional campaigns can be supported by the tea industry to boost per capita tea consumption, particularly in the producing countries themselves. Initiatives that link tea to evidence-based health benefits of drinking tea can also support the demand side of the market. Policies to remove sub-standard tea exports should also be sought, together with raising product quality and safety.

27. Investing into innovative approaches and technology can create the financial buffer needed to cope with price volatility. The objective would be to reduce costs, yet strengthen the sustainability of the tea sector in all its dimensions - environment, economic and social. Finally, the creation of value through tea processing at origin can also reduce exposure to the volatility of tea prices. This depends, however, on the willingness of the major importing countries, including tea producing countries, to cut tariffs on high value tea products.

VI. CONCLUSION

28. This study uses a structural vector autoregression method to identify the main drivers of price volatility in the world tea market. Four major sources of price movements are selected based on economic literature and the specific nature of the tea market. These are: 1) the global economic activity, as a proxy for shifts in aggregate demand; 2) changes in net supply of tea, to account for tea-specific demand and supply shocks; 3) the value of the USD with respect to major other currencies; and 4) oil prices, as a proxy for energy costs. The applied framework separates the effects of these four factors and estimates the extent of their contribution in explaining tea price booms and busts. Identification is achieved by exploiting the existence of different volatility regimes. Results indicate that the bulk of the price movements in the tea market is attributed to shocks that are specific to the sector, that is changes in the fundamentals of tea demand and supply. Crude oil and real economic activity also play a role, but their effects are found to be small and short-lived. It should be noted, however, that the impact of the economic activity on tea prices was greatest in the first three months of 2020, coinciding with the onset of the COVID-19 pandemic and the resulting lockdowns and global economic downturn.

REFERENCES

Alam, M.R. & Gilbert, S. (2017). Monetary policy shocks and the dynamics of agricultural commodity prices: Evidence from structural and factor-augmented VAR analyses. Agricultural Economics, 48(1), 15–27. https://doi.org/10.1111/agec.12291

Bruno, V.G., Büyükşahin, B. & Robe, M.A. (2017). The Financialization of Food? American Journal of Agricultural Economics, 99(1), 243–264. https://doi.org/10.1093/ajae/aaw059

Carter, C.A., Rausser, G.C. & Smith, A. (2017). Commodity Storage and the Market Effects of Biofuel Policies. American Journal of Agricultural Economics, 99(4), 1027–1055. https://doi.org/10.1093/ajae/aaw010

Hall, P. (1992). The Bootstrap and Edgeworth Expansion (1992° edizione). Springer Verlag.

Hao, N., Pedroni, P., Colson, G. & Wetzstein, M. (2017). The linkage between the U.S. ethanol market and developing countries' maize prices: A panel SVAR analysis. Agricultural Economics, 48(5), 629–638. https://doi.org/10.1111/agec.12362

Headey, D. & Fan, S. (2008). Anatomy of a crisis: The causes and consequences of surging food prices. Agricultural Economics, 39(s1), 375–391. https://doi.org/10.1111/j.1574-0862.2008.00345.x

IMF (2008). Food and fuel prices-Recent developments, macroeconomic impact, and policy responses-An Update. Policy Papers series. International Monetary Fund, Washington DC.

Janzen, J.P., Smith, A. & Carter, C.A. (2018). Commodity Price Comovement and Financial Speculation: The Case of Cotton. American Journal of Agricultural Economics, 100(1), 264–285. https://doi.org/10.1093/ajae/aax052

Juvenal, L. & Petrella, I. (2015). Speculation in the Oil Market. Journal of Applied Econometrics, 30(4), 621–649. https://doi.org/10.1002/jae.2388

Kaldor, N. (1976). Speculation and Economic Stability. In B. A. Goss & B. S. Yamey (Eds.), The Economics of Futures Trading (pp. 111–123). Palgrave Macmillan UK. https://doi.org/10.1007/978-1-349-02693-7_6

Kilian, L. (2009). Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market. American Economic Review, 99(3), 1053–1069. https://doi.org/10.1257/aer.99.3.1053

Kilian, L. (2013). Structural vector autoregressions. Handbook of Research Methods and Applications in Empirical Macroeconomics. Edward Elgar Publishing. https://www.elgaronline.com/view/edcoll/9780857931016/9780857931016.00031.xml

Kilian, L. & Lütkepohl, H. (2017). Structural Vector Autoregressive Analysis. Cambridge University Press.

Kilian, L. & Murphy, D. P. (2014). The Role of Inventories and Speculative Trading in the Global Market for Crude Oil. Journal of Applied Econometrics, 29(3), 454–478. https://doi.org/10.1002/jae.2322

Lombardi, M. J. & Van Robays, I. (2011). Do Financial Investors Destabilize the Oil Price? (SSRN Scholarly Paper ID 1847503). Social Science Research Network. https://doi.org/10.2139/ssrn.1847503

Qiu, C., Colson, G., Escalante, C. & Wetzstein, M. (2012). Considering macroeconomic indicators in the food before fuel nexus. Energy Economics, 34(6), 2021–2028. https://doi.org/10.1016/j.eneco.2012.08.018

Rigobon, R. (2003). Identification Through Heteroskedasticity. The Review of Economics and Statistics, 85(4), 777–792. https://doi.org/10.1162/003465303772815727

Sims, C. A. (1980). Macroeconomics and Reality. Econometrica, 48(1), 1–48. https://doi.org/10.2307/1912017

Stuermer, M. (2018). 150 years of boom and bust: What drives mineral commodity prices? Macroeconomic Dynamics, 22(3), 702–717. https://doi.org/10.1017/S136510051600050X

Working, H. (1949). The Theory of Price of Storage. The American Economic Review, 39(6), 1254–1262.