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Original Article

Price Distortions and Export Competitiveness: Evidence from India's Rice and Wheat Economy

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Abstract *- India's Wheat and rice economy is at the core of the country's food security and agri-exports, which reached all-time highs in 2023-24. Although the widening gap between Minimum Support Price (MSP) and wholesale prices has challenged country competitiveness elsewhere in the world, this study explores the role of these gaps in shaping rice and wheat exports, based on secondary time-series data from 2001 to 2023. The trend analysis shows that the MSP–wholesale price spread for both rice and Wheat widened steadily across the years. In contrast, export values were highly volatile, with rice peaking during 2011–13 and again in 2020–21, while Wheat depicted major highs in 2012 and 2020 before steep declines. The Vector Autoregression (VAR) results revealed distinct crop-level dynamics. For rice, current exports are significantly and negatively affected by both the previous year's export volumes and the price gap between wholesale price and MSP. This means that wider price spreads make India less competitive in global markets, and years with high exports are often followed by declines, most likely because of stock adjustments or restrictive trade policies. For Wheat, exports are influenced only by their own lagged values, indicating persistence in demand and a stronger role of government trade controls than domestic price gaps. Wheat exports respond mainly to policy interventions and stable demand, while rice exports are highly sensitive to MSP distortions and global price competitiveness. Based on the results, this study proposes a differentiated, crop-specific MSP and procurement policy that can safeguard farmer welfare while preserving India's competitiveness in international markets.*

Keywords *- Agriculture, Exports, Minimum Support Price (MSP), Price Gap, Rice, Wheat, Wholesale Price.*

1. Introduction

1.1. General Background

India is one of the biggest agricultural centers of the globe. During 2023-24, India attained an impressive. Agriculture production figure of 3322.98 LMT, topping its earlier high of 3296.87 LMT marked in 2022-23 by a significant 26.11 LMT, registering a historic high in terms of output. Most of this phenomenal yield originated from wheat and rice crops [1]. For 2023-24, rice production is poised to attain a new high of 1378.25 LMT, registering an increase of 20.70 LMT from its earlier Production high of 1357.55 LMT in 2022-23. For Wheat, too, a new high of 1132.92 LMT for 2023-24 is anticipated, registering an increase of 27.38 LMT from its rival figure of 1105.54 LMT of 2022-23, making both rice and wheat cornerstones of India's food economy [1]. Rice and Wheat are predominantly cultivated in northern India, especially in more agriculturally developed provinces of Uttar Pradesh, Haryana, and Punjab, where geographical benefits, including natural soil, ease cultivation significantly [1,2]. On an economic front, Wheat and rice exports have significantly enhanced agricultural exports, reaching a record $48.15 billion, positioning India as a leading agricultural exporter historically [3]. Since agriculture doubles as a pillar of India's new economy, giving an occupation to about 46.1% of the total workforce and contributing about 16.24% towards the country's Gross Domestic Product (GDP), the importance of agriculture is immediately understood [4].

However, even though there is this heavy reliance on agriculture, there is still a lot of disparity between how much the agricultural sector produces and how many people rely on the agricultural sector for employment. In the past couple of decades, there has been a steady decline in the number of people who work in the agricultural sector. For example, in the 1993–94 period, about 62 percent of India's workforce was employed in agriculture, but in 2023, 43.5 percent of India's employed population worked in agriculture. That is a serious reduction of about 18.5% in a little more than 2 decades [5,6].

There are a number of explanations for this declining strength. Firstly, it is necessary to take into consideration an increase in non-agricultural employment, especially in towns. As industry, construction, and commerce expanded, a great mass of villagers migrated into townships in pursuit of better pay and more secure jobs [7]. Another significant factor is found in the climatological circumstances of the north Indian states; irregular weather patterns, prompted by global warming, have made farming risky. Sporadic monsoons, unexpected famines, and floods have brought with them fluctuating agricultural revenues, resulting in many individuals moving towards finding jobs in other fields [8]. Beyond these structural shifts, however, the decline also reflects the shortcomings of government agricultural policies. Despite decades of initiatives intended to secure farmer welfare, implementation has often been uneven, with benefits concentrated in a few states and large farmers while smallholders remain exposed to risk. Subsidy schemes, irrigation programs, and procurement policies have frequently failed to deliver equitable outcomes, leaving many cultivators disillusioned. In this context, the Minimum Support Price (MSP) regime becomes particularly important. Originally designed as a safety net to protect farmers from sharp price declines, the MSP system has instead revealed deep flaws: unequal access across regions, distorted cropping incentives, and a growing fiscal burden that has not translated into broad-based rural security [9].

The Minimum Support Price is a fixed price at which the Government of India undertakes to buy crops from producers, irrespective of going rates in markets or demand-and-supply dynamics of a free economy. A guaranteed price floor is set before the sowing season to ensure farmers get a minimum profit for their produce, even if market prices fall. This system was introduced to protect the livelihoods of farms from market price fluctuations. In the 2023 to 2024 crop planting season the MSP for Wheat was set at ₹2,125 per quintal and ₹2,183 per quintal for common paddy (rice), to support farmers further, and due to inflation these MSPs were raised again in the 2024 to 2025 planting season, the new rates being ₹2,275 for Wheat and ₹2,300 for paddy (rice) [1,3,10]. The problem with MSP is not the price offered to the farmers but rather which farmers it is available to. Access to MSP is not equal across all states in India, meaning states with more resources for farming, like Punjab, benefit more from the MSP than states like Bihar or Uttar Pradesh. These states are not able to take advantage of this nationalized MSP due to a lack of nearby procurement centers or timely access to institutional buyers, leading to these farmers having to see their product below MSP-guaranteed prices, in some situations, facing a loss. This is seen by the amount of Wheat procured from Punjab in 2024, 262.48 LMT wheat procured in Central Pool, benefitting 22.31 lakh farmers and providing MSP of Rs. 59,715 crores. Notably, Punjab contributed the most Wheat, 124.26 LMT, versus the mere 9.07 LMT contributed by Uttar Pradesh [4,10].

The interstices between announced Minimum Support Prices (MSPs) and market prices impact farmers' revenues and determine India's broad food policy. Because MSPs are announced before relevant crops' planting seasons, only an educated estimate can be made of the optimum price [11]. If MSPs are fixed above marketplace costs, the government must buy into a farmer's entire stock at these high MSPs. Consequently, payment rates become more than the market price, triggering complete buyouts from producers who can only maximize their returns. Such a gap between MSPs and market price imposes a significant fiscal burden on government allocations while concurrently inhibiting export competitiveness as well [12]. As of May 9th, 2025, rice stocks amount to 356.42 Lakh Metric Tonnes (LMT), significantly more than the target of 135 LMT considered necessary as a buffering element.

Likewise, wheat stock has a total of 383.32 LMT, significantly more than the regulated norms of 276 LMT for Wheat. This indicates a surplus well in excess of buffers deemed necessary by regulations, thereby guaranteeing an end to food insecurity in India [13]. Even so, this surplus entails storage, maintenance, and additional governmental administrative costs, presenting challenges once crop stocks are transitioned from farms. It highlights a need for more accurate MSP pricing and more governmental planning to eliminate extended strains on resources brought about by tax levies.

1.2. Specific Background

The MSP regime was formulated with a view to protecting Indian producers from turbulent swings of market prices. It constituted an important safety net. Some time before the sowing season, the government would announce a price, indicating its intention to procure a given crop, for example, rice or Wheat. This guarantee was an important factor in averting the collapse of market prices, enabling producers to count on a reliable source of revenue. Progressively, this approach developed into a pillar of India's initiative towards food security as well as towards improving rural livelihoods [14].

Numerous researchers have explored this complex mechanism. For example, Kozicka and co-researchers undertook a paper to explore the impact of MSPs' and government procurement policies on Wheat and rice markets in India. Based on national-level datasets from 1982 until 2012, they explored MSPs' consequences for Production and trade and MSPs' impact on the price mechanism. Through their research, they discovered that MSPs induce Production and create government stockpiles of surplus foodstuffs, all of which go hand in hand with distorting market forces [15]. As per a study done in 2021 by Saini and Kozicka, the researchers explored crop distribution dynamics as well as procurement verification under regime MSPs. Their research discovered that although MSP ensures price stability for crop growers, it often leads to surplus procurement in states like Punjab that enjoy strong infrastructural benefits. On the contrary, Bihar experiences procurement deficiency because of poorly equipped centers, although its growers face equally adverse conditions [16].

Subsequently, research for the Madhya Pradesh and Punjab districts revealed that MSP offers uneven benefits to some districts due to the more advanced market infrastructure available. Thus, whereas MSP was intended as a national program, its implementation can vary significantly from place to place. For rural populations in some parts of Bihar or West Bengal, MSP benefits often prove inaccessible [17]. As recently surveyed in Venkatesh, statistics compiled for the NSSO pointed out that farm size, awareness, as well as procurement distances significantly determine a farmer's capability of selling at the MSP, however, very few farmers, those who come from Punjab as well as Haryana, truly reap its benefits, with a very high population of cultivators remaining ineligible for its benefits [18]. When it comes to exports, a study found that having MSPs consistently set above international market prices actually hurts India's ability to export. If rice is too expensive because of MSP, buyers will just go elsewhere. The government is then stuck with huge grain stocks that it cannot really sell globally. Similarly, Kumar pointed out in 2014 that rising MSPs combined with massive procurement under the Food Security Act are becoming too expensive for the government to manage in the long term [19,20].

Other scholars have extended these arguments. In 2016, a study argued that the dominance of rice and Wheat under the MSP regime has depressed exports of alternative staples such as coarse cereals and oilseeds [21]. By over-incentivizing procurement of MSP-backed crops, India's trade patterns became skewed, leaving limited room for diversification in global markets. A study by Suwen Pan and colleagues at Texas Tech University further confirmed this broader trend by showing how MSP hikes for cotton raised domestic prices and distorted India's position in the international cotton trade. Though outside rice and Wheat, this evidence reinforces the point that MSP-induced price floors consistently reduce export competitiveness across commodities [21].

More recent evidence points to the same conclusion. Government and trade reports noted that in 2023–24, India's curbs on rice and Wheat exports, driven partly by MSP and procurement-linked concerns, cut overall agricultural export earnings by nearly USD 5–6 billion. This demonstrates the direct trade-off between domestic procurement policies and international competitiveness [22].

The gap between MSP and market prices has also been the subject of specific studies. Research in India found that MSP announcements are often politically timed, with higher MSPs announced in states approaching elections, irrespective of market realities. Such politically motivated price floors widen the MSP–market gap and distort both Production and trade. Similarly, Nitin Gadkari, a senior Union Minister, publicly acknowledged in 2019 that MSPs are often higher than both domestic and international market prices, warning that this mismatch risks creating an "economic crisis" by undermining exports and raising unsustainable procurement costs [17].

1.3. Literature Gap and Rationale of the Study

A review of the available literature reveals that, while a considerable body of research exists on studying MSP's impact on domestic Production, farm income, and the fiscal burden of government, a noticeable gap exists in connecting state-level MSP–market price gaps to export outcomes, particularly for staple crops like rice and Wheat. Most of the available literature falls back on national averages, though this view hides from us the fact that outcomes of policies differ considerably for various regions of India. For example, a region like Punjab, which is endowed with strong procurement networks and infrastructure, shows very different outcomes from a region like Bihar or Odisha, where it is hard for farmers to avail of MSP benefits. We notice a noticeable lack of crop-wise, region-wise time-series analyses connecting localized price gaps with actual trends of export, something this paper aims to address.

This study is essential because India must combine the help of farmers with maintaining competitiveness in global trade. Wheat and rice are not just the foundation of India's food system; they also play a huge role in exports [8]. Suppose the Minimum Support Price (MSP) is inconsistent between states, and farmers in crucial producing areas are unable to obtain equitable prices or efficiently market their commodities. In that case, both domestic and international consequences are influenced. India is producing more food than ever before, but also holding onto massive stocks of grain while facing rising food costs. By digging into how MSP-market price gaps work across different states and assessing how they connect to export outcomes, this study will help make future agricultural policy more accessible [1]. It can show where the real choke points are, whether in pricing, infrastructure, or procurement, and help make the system more fair and efficient for farmers in the future, leading to more farmers continuing to work in agriculture rather than the other options available.

1.4. Broader Aim of the Study

To quantify and explain how Minimum Support Price (MSP)–wholesale price differentials shape India's export competitiveness in rice and Wheat between 2001 and 2023, distinguishing market-driven forces from policy-driven effects. Using trend analysis and VAR modeling, the study seeks to identify the dynamic channels—lagged exports, Production, global price indices, and the INR/USD exchange rate—through which price gaps affect export performance, and to contrast crop-specific patterns (rice's sensitivity to pricing distortions versus Wheat's policy-led persistence). The overarching aim is to generate actionable, crop-differentiated procurement and MSP recommendations that safeguard farmer welfare while preserving international competitiveness, reducing excess stocks and fiscal burdens, and improving the predictability of India's agri-trade outcomes.

2. Methodology

2.1. Research Aim and Objectives

This paper seeks to examine how disparities between the Minimum Support Price (MSP) and wholesale crop prices influence India's agricultural exports, specifically its two foremost staple crops: rice and Wheat. The paper's core argument claims that although MSP is a pillar of India's agricultural policies, its impact differs from place to place, thus having significant effects on trade flows [23]. The broader aim is to show the impact of the price gap between MSP and wholesale prices on India's export of these crops. These two crops have been chosen because they dominate food production in India and account for a significant share of government procurement, public food distribution, and agricultural exports. The study aims to quantify the gap between MSP and average wholesale market prices across states that are major producers of Wheat and rice, and then analyze these price gaps to determine how they affect the volume of rice and wheat exports from India [24]. The following objectives have been explored in the study.

- To interpret the trends in the gaps between MSP and wholesale prices of Rice and Wheat
- To assess the trends in India's exports of Rice and Wheat
- To analyze the relationship between the price gaps and the export values of Rice and Wheat

2.2. Research Hypotheses

- No individual impact of the lagged exports, price gap, Production, sub-index, and exchange rate on the current period exports
- No individual impact of the lagged exports, price gap, Production, sub-index, and exchange rate on the current period price gap
- No individual impact of the lagged exports, price gap, Production, sub-index, and exchange rate on the current period production
- No individual impact of the lagged exports, price gap, Production, sub-index, and exchange rate on the current period sub-index
- No individual impact of the lagged exports, price gap, Production, sub-index, and exchange rate on the current period exchange rate

All the above hypotheses are being tested for each variable on an individual basis for both crops.

2.3. Data

The data used for this paper were retrieved from government sources using a secondary method of data collection. This dataset consisted of time series from 2001 to 2023, emphasizing the two main crops of significance for Indian exports: rice and Wheat. Such varieties of crops are of crucial importance not only as a product but also in value for export, and they are widely procured under the Minimum Support Price scheme, thus making them perfect subjects for research. The dataset was compiled from multiple government sources. Minimum Support Price (MSP) figures were obtained from the Commission for Agricultural Costs and Prices (CACP), while average wholesale price data were collected from the Agmarknet portal of the Department of Agriculture & Farmers Welfare [25]. Export values (in USD) for rice and Wheat were sourced from the Directorate General of Commercial Intelligence and Statistics (DGCIS) through the Ministry of Commerce [28]. Production figures (in tonnes) were drawn from the Ministry of Agriculture and Farmers Welfare's *Agricultural Statistics at a Glance* [26]. Finally, procurement and stock levels were cross-verified using reports from the Food Corporation of India (FCI) [27]. Variables examined were Price Gap, Production in tonnes, Sub Index, Exchange rate in terms of Local units of currency per USD, as well as Export Value in 1000 USD.

2.4. Description of Variables

To understand how the price gaps have influenced Indian exports of farm products, specifically with reference to rice and Wheat, this paper considers five crucial variables. The variables were chosen because they link India's MSP policy with trade outcomes: exports capture market performance, the MSP–wholesale gap shows competitiveness, Production reflects exportable surplus, the sub-index accounts for global price trends, and the exchange rate measures currency effects on export affordability.

- **L_Exports:** Exports are valued in thousands of United States dollars and are the main explanatory variable. This variable captures the annual value of rice and wheat exports from India and is used to test whether the Minimum Support Price (MSP) creates a price gap that affects international sales.
- **Price_Gap:** The price gap (₹/quintal) represents the Difference between the guaranteed price paid to producers (MSP) and the wholesale market price, which reflects the prevailing market value. A wider gap indicates that MSP is significantly higher than the market price. Such conditions can hinder exports by inflating domestic prices and reducing the competitiveness of Indian cereals in global markets.
- **L_Production:** Production (in tonnes) denotes India's annual harvest of rice or Wheat. This variable is important for gauging the availability of exportable grain. Higher Production typically reflects stronger supply, which in turn influences domestic prices and international trade behavior.
- **Sub_Index:** The Sub-Index, expressed as an international price index for rice and Wheat, indicates global market trends. When international prices decline, Indian crops with relatively high MSPs face increased competition from other suppliers. This index is therefore a critical external factor in assessing export performance.

- **Exchange_Rate:** The exchange rate (₹/USD) measures the value of the Indian rupee relative to the United States dollar. Since export earnings are dollar-denominated, fluctuations in the exchange rate directly affect competitiveness. A depreciated rupee makes Indian exports more affordable to international buyers, potentially increasing demand, while an appreciated rupee has the opposite effect.

2.5. Data Analysis Method

2.5.1. Trend Analysis

Trend analysis is a statistical method used to identify patterns, movements, or shifts in data over time, helping to detect long-term directions beyond short-term fluctuations. It is important because it allows researchers to understand whether variables are rising, falling, or remaining stable, and to connect these changes to underlying economic or policy factors. Wheat's and rice's trends were plotted against the MSP-wholesale price differential and export values. This analysis aims to identify any potential trends or associations. During the study, it was observed that the price gaps for both crops increased continuously over time, with exports exhibiting significant volatility, as they did not maintain a consistent trend [29].

2.5.2. Stationarity

Since time series data was being used in the analysis, it was important to check whether the data was stationary. Stationarity means that the key statistical properties of the data, such as average and variance, stay consistent over time. If the data is not stationary, then the model's patterns might result from long-term trends instead of actual relationships between variables. If stationarity is not confirmed, the results of the analysis could be misleading or unreliable.

To make sure the time series data could be properly used in the analysis, the Augmented Dickey-Fuller (ADF) test was used to check for stationarity—the ADF test checks whether the data stays stable over time [30]. The null hypothesis of this test assumes that the data is non-stationary. If the p-value comes out to be greater than 0.05, it means the data is not stationary, so differencing is needed to make the series more reliable before running models.

The stationarity test indicates that none of the rice variables were stationary at the level. The p-values for l_Exports (0.723), Price_Gaps (0.778), Sub Index (0.899), Exchange Rate (0.924), and Production (0.519) were all above 0.05. However, at the first order price gap, all of these variables became stationary, implying the adequacy of the variables in the model. Variables with respect to Wheat showed a similar result. At the level, the variables, l_Exports (0.611), Price_Gaps (0.765), Sub_Index (0.997), Exchange_Rate (0.928), and l_Production (0.505), were also non-stationary, but became stationary after first-order differencing.

2.5.3. Model Specification

Once all the variables were stationary, the study used a Vector Autoregression (VAR) model to study how the variables might be affecting each other over time. The Vector Autoregression (VAR) model was used because it allows all variables within the system to be treated as potentially interdependent. This makes it particularly suitable for examining whether factors such as the MSP–wholesale price gap, production levels, international price indices, or exchange rates in the previous year exert a measurable influence on current export values. For rice and Wheat, the model passed the VAR stability condition, which means the model setup was solid and the results could be trusted. The VAR model for both crops in matrix form is formulated as follows.

$$Y_t = c + AY_{t-1} + u_t$$

Where,

- $Y_t = [y_{1t} \ y_{2t} \ y_{3t} \ y_{4t} \ y_{5t}]'$ is the (5×1) variable vector
- $c = [c_1 \ c_2 \ c_3 \ c_4 \ c_5]'$ is the (5×1) vector of intercepts
- A is the (5×5) matrix of lag-1 coefficients
- $u = [u_1 \ u_2 \ u_3 \ u_4 \ u_5]'$ is the (5×1) residual vector

Herein, $Y_t = [L\_Exports_t \ Price\_Gap_t \ L\_Production_t \ Sub\_Index_t]$

2.5.4. Stability Condition for VAR

As part of checking the reliability of the VAR model, the eigenvalue stability condition was tested for both crop models. In simple terms, this condition helps confirm that the model will not give unstable or explosive results over time. This is checked by looking at whether the absolute values of all the eigenvalues fall inside the unit circle, which means they should be less than 1 [31]. For both the rice and wheat models, this condition was met. The highest modulus value for rice was 0.6518, and for Wheat it was 0.6064, well below the threshold of 1. This means that the VAR models for both crops are stable, and the relationships between the variables can be trusted for policy interpretation.

2.5.5. Autocorrelation

Autocorrelation was checked for both models to ensure that the errors from one year were linked to those in another year, which would create a bias in the results [32]. The Lagrange Multiplier (LM) test was run on the residuals, and for both crops, the p-values were above 0.05. So, there was no sign of autocorrelation, which means the model results were reliable.

3. Results

3.1. Trend Analysis

This section of results shows the trend analysis of the two main variables of the study, Price Gap and Exports, for rice and Wheat. Figure 1 shows the trend of the Wholesale–MSP price gaps for rice from 2000 to 2023. Focusing on rice trends, the price gap has generally widened over time. In the early 2000s, the margin was around Rs. 30, but by 2023 it had reached nearly Rs. 100, showing that MSPs increased more sharply than wholesale prices over the long run. However, the movement in 2013–2014 was different. During this period, both MSP and wholesale prices rose, but wholesale prices increased by a larger margin than MSP. As a result, the gap between the MSP and wholesale prices narrowed slightly rather than widening [33]. This change reflected stronger movements in market prices relative to government-set MSP, likely driven by a combination of robust domestic demand and temporary price support from global markets, which pushed wholesale prices upward faster than the announced MSP [33].

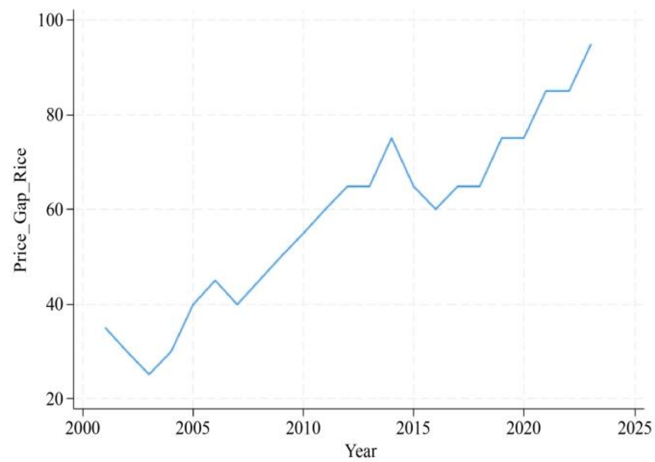

Fig. 1 Trend line for the price gap between the Wholesale price and the MSP of Rice (2000-2023)

From 2014 to 2016, the chart shows a decrease in price gap, indicating a transient drop in the differential between MSPs and wholesale prices. This movement took place during a time when the government took a proactive procurement approach. They started procuring additional rice at the minimum support price, using this strategy in particular to insulate farmers from both the international volatility of rice prices and from increasing costs internationally. Through building up additional rice stocks at high MSPs, the government effectively averted the wholesale market from being oversaturated with extra stocks, which would have pushed prices lower still towards the MSP [20]. This transient decline in the differential came right as the renewed long-term expansion of the gap started again after 2016.

From 2016 to 2025, the chart shows a sharp and continuous rise in the MSP–wholesale price gap, indicating that wholesale prices rose at a faster pace than MSPs during this period as well. While the government steadily raised MSPs, paddy MSP moved from ₹1,410 per quintal in 2015–16 to over ₹2,300 in 2025. Wholesale prices increased even more sharply, increasing the Difference between the two. This trend reflects the influence of strong market demand, rising production costs passed into market prices, and global supply factors that pushed wholesale prices upward [34]. In effect, while MSP hikes remained important for farmer support, actual market dynamics played a larger role in shaping prices during this period, causing the observed rise of the MSP–market price gap.

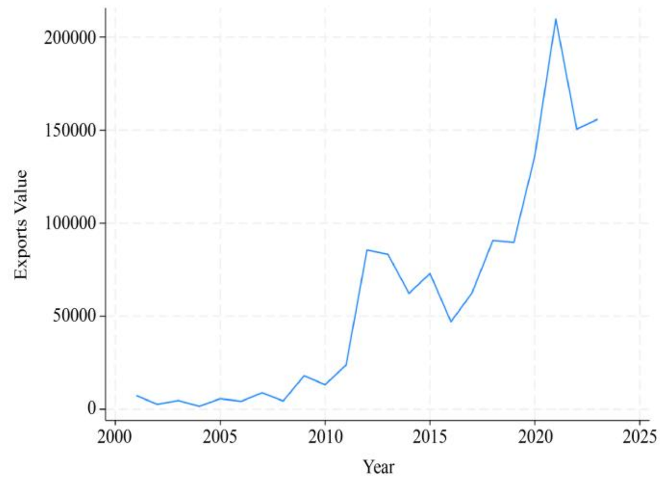

Fig. 2 Trend line for the Rice exports (2000-2023)

The graph in Figure 2 depicts the trend of rice export values from India between 2000 and 2025, measured in thousands of U.S. dollars. In contrast to MSP and wholesale price, rice export value has seen major fluctuations. From 2001 to about 2010, exports stayed low and fairly flat, not crossing the 20,000 (1000 USD) mark. However, around 2011-2013, there was a sudden spike, with export values climbing sharply and crossing 100,000 (1000 USD) in 2019. This sudden spike can be linked to multiple global and domestic factors. India launched a historic policy move in September 2011 when it ended the export ban on non-basmati varieties of rice and thus opened up newer international market avenues for its export houses. However, its main competitor in the rice market, Thailand, had been on a rice pledging scheme that raised its domestic purchase prices and thus made Thai rice expensive and less competitive internationally [35]. Consequently, several buyers started showing keen interest in offers from India that proved cost-competitive. This move received further support from a healthy demand worldwide, especially from countries such as Iran and Nigeria, and also from some others in the Middle East and African regions, all of whom intensified importations owing to the prevailing supply issues [36].

Yet from 2012 to 2016, exports of rice fell. This decline was due to policies from the government that imposed minimum export prices, duties, and other measures designed to control domestic inflation and respond to food security issues [37]. These restrictions disrupted the unrestricted flow of rice exports. At the same time, competitors like Thailand regained market share and started to export again at competitive prices. In response, the customary Indian purchasers began looking elsewhere for purchasing opportunities and thus reduced the volume that India exported [37].

Conditions picked up from 2016, and a clear positive trend emerged and persisted until 2021. In all that time, export values remained continuously higher and higher, aided and abetted by various driving forces. In India, meanwhile, production levels of rice also remained consistently higher during the same time frame due to supportive climate parameters and greater usage of higher-yielding varieties of crops. That surplus value produced over and above domestic usage ended up finding its way to the export quantities [38].

Having survived the waves of rising and falling fortunes, the industry experienced a stunning rush around 2019, with rice exports hitting unprecedented levels above 200,000 (1000 USD). That unprecedented growth largely emanated from supply chain disruptions and massive procurement drives.

The import orders from the importers' countries rose drastically, particularly all over Africa, including countries like Senegal, Djibouti, the Ivory Coast, Ethiopia, and some parts of Asia. In many instances, several importers who used to look elsewhere for their requirements started noticeably looking towards India for reliable supplies [39]. A major depreciation, nevertheless, re-emerged after 2021.

The growth explosion during this time can be attributed to two main drivers. Firstly, the country registered a record rice production during the 2020-21 season and reached almost 130 million tonnes. The export surplus thus created from the same exceeded domestic demand and allowed exporters to ship massive quantities abroad [40].

Secondly, international demand for rice rose during the COVID-19 pandemic. Rice-exporting nations like Thailand and Vietnam faced supply shortages themselves and sought import-dependent countries from Asia, Africa, and the Middle East regions to supply their food needs [41,42].

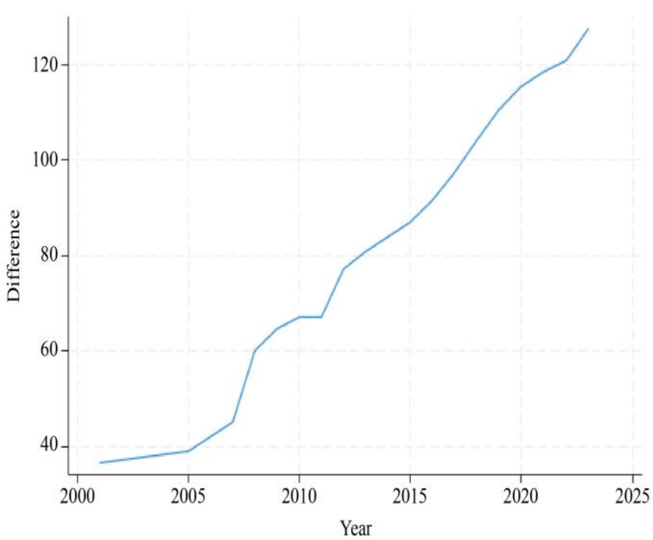

Fig. 3 Trend line for the price gap between the Wholesale price and the MSP of Wheat (2000-2023)

The line graph in Figure 3 represents the gap between the wholesale price and the MSP of Wheat from 2000 to 2023. The trend begins around ₹40 in the early 2000s and then shows a steady and continuous rise, with the gap exceeding ₹120 by 2023. This indicates that wholesale prices were consistently above MSP throughout the period, and they also increased at a faster pace than MSP.

Between 2007 and 2014, the gap widened significantly. During this time, the Government of India raised MSPs to support farmers, but wholesale prices in the open market rose even faster. Strong domestic demand, higher procurement incentives, and global price movements pushed wholesale prices upward at a sharper rate compared to MSP, causing the gap to grow [43].

From 2014 to 2016, the upward trend in the gap continued, albeit at a slower pace. This coincided with two consecutive weak monsoons in 2014 and 2015, which limited wheat supply and caused wholesale market prices to rise, outpacing MSP hikes [44].

From 2016 onwards, the gap continued to climb consistently. This reflects a period when both MSP and wholesale prices kept increasing, but wholesale prices surged faster due to strong demand, export opportunities before 2022, and inflationary pressures in food markets [45]. Even though the government raised Wheat MSP from ₹1,525 per quintal in 2016–17 to ₹2,275 in 2023–24, wholesale prices maintained a higher growth trajectory [46].

By 2023, the wholesale–MSP gap crossed ₹120, highlighting that market-driven prices consistently exceeded government support prices. This reflects robust demand and inflationary effects on food commodities, showing that while MSP policy guaranteed farmers a safety net, actual market dynamics ensured higher returns than government procurement prices [46].

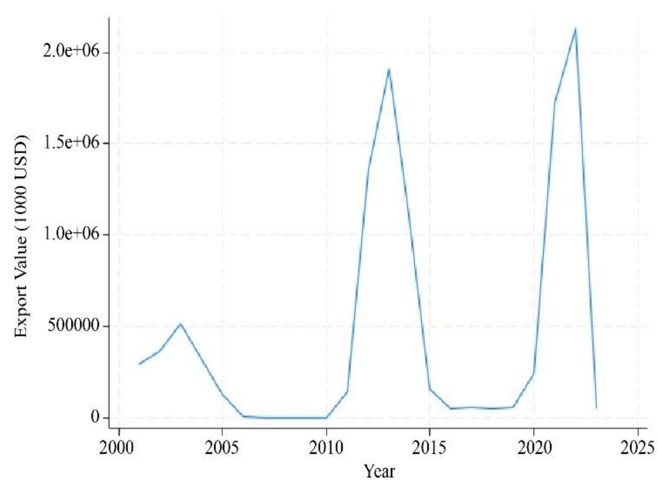

Fig. 4 Trend line for the Rice exports (2000-2023)

Figure 4 depicts the trend of wheat export values from India between 2001 and 2023, measured in 1000 USD. The graph highlights the extreme volatility of wheat exports, showing long periods of near-zero export activity, followed by sharp spikes in certain years. From 2001 to around 2010, export values were minimal, but then a massive jump occurred between 2010 and 2013, touching nearly 2 million USD. This surge can largely be explained by India's shift in export policy and global market dynamics. The Indian government liberalized wheat exports under the 2011–12 trade policy, making them free from restrictions [47]. This was in response to several consecutive years of bumper harvests, which had led to domestic stocks far exceeding buffer norms. After this spike, the wheat export fell in 2014 and did not recover till late 2018, due to poor monsoon, unseasonal rains, and hailstorms affecting both types of wheat crops [48].

After 2018, exports quickly recovered, and there was a sharp rise in wheat exports from India in 2020. This was due to two major reasons. First, India saw strong domestic wheat production during this time, with stable and high output, creating enough surplus to export without affecting domestic consumption. Second, global demand for Wheat increased sharply due to major supply disruptions [49]. The COVID-19 pandemic had already strained global food logistics, and the situation got worse when the Russia-Ukraine conflict began in early 2022. Since both Russia and Ukraine are among the world's top wheat exporters, the war created a massive gap in global supply, and hence the demand of the nations that rely on Wheat from Russia and Ukraine shifted to India, and Indian exports of Wheat increased [50]. For 2022, the value of wheat exports saw another sharp decline. It occurred primarily because India suspended wheat exports in May 2022 due to domestic food price inflation and food security. The government suspended private wheat exports and approved limited exports in the disguise of governmental sales between governments. Their implications were that, despite the fact that formerly there would be constant international demand along with high domestic turnover, export levels declined sharply during the period [33]. What became a general policy letdown had a heightened impact on India's wheat trade scenario, illustrating how export restrictions, even during a surplus period, could immediately undermine trade performance.

3.2. Vector Auto-Regression (VAR) Analysis

The tables below show the results of the VAR model used to understand the relationship between MSP and wholesale price gaps and agricultural exports of rice and Wheat.

Table 1. Results for the VAR model with respect to Rice

	L_exports	Price_Gap	Sub_index	Exchange_ Rate	L_Production
L_exports (-1)	-0.585	1.866	-3.471	0.422	0.010
	(0.166)	(1.689)	(7.278)	(0.950)	(0.012)
	0.000***	0.269	0.633	0.657	0.415
Price_Gap (-1)	-0.048	-0.261	0.614	-0.164	0.001
	(0.018)	(0.181)	(0.778)	(0.102)	(0.001)
	0.007***	0.149	0.430	0.107	0.701
Sub_index (-1)	0.001	-0.156	0.223	-0.036	0.000
	(0.006)	(0.058)	(0.250)	(0.033)	(0.000)
	0.814	0.007***	0.373	0.271	0.304
Exchange_Rate (-1)	0.020	-0.695	0.011	0.114	-0.008
	(0.039)	(0.401)	(1.727)	(0.226)	(0.003)
	0.612	0.083*	0.995	0.613	0.005***
L_Production (-1)	-0.414	-36.149	19.911	7.921	-0.611
	(1.341)	(13.662)	(58.871)	(7.688)	(0.099)
	0.758	0.008***	0.735	0.303	0.000***

*Standard errors in parentheses, and p-value below standard errors; ***p<0.01, **p<0.05, *p<0.1*

Table 1 represents the results for the VAR model with respect to rice. It shows the five models, and row 1 depicts the dependent variables. In the first model, wherein the dependent variable is rice exports, the previous year's value of exports significantly impacts the current export value at a 1 percent significance level (p = 0.000). The negative coefficient (-0.585) shows that a 1 percent increase in exports last year leads to a 0.585 percent drop in the current year's exports. Similarly, the Price_Gap (-1) is also significant, with a p-value of 0.007 and a coefficient of -0.048. It indicates that a one rupee rise in the last year's price gap reduces current year's exports by 4.8 percent. However, the other variables, Subindex, Exchange Rate, and Production, are not statistically significant, and hence, they do not influence exports in this model.

In the next model, wherein the dependent variable is the price gap in MSP and wholesale prices (Price_Gap), it can be seen that the Subindex is significant at the 1 percent level (p = 0.007) with a coefficient of -0.156. This implies that a one-unit increase in the last period's Subindex leads to a 0.156 rupee decrease in the current period's price gap. Moreover, the exchange rate and rice production influence the price gap of rice. The exchange rate is significant at the 10 percent level (p = 0.083) with a coefficient of -0.695, which suggests that a higher exchange rate or a weaker rupee in the previous year tends to reduce the pricing gap in the current year. Production is also significant at 1 percent (p = 0.008) and has a large negative coefficient of -36.149, showing that when the rice production increases by one ton in the last year, the price gap between MSP and market prices tends to drop sharply by Rs. 36.149 in the present year. However, the other two variables, last year's exports and last year's price gap, are not significant in this model, implying no impact on the current year's price gap.

Subsequently, when the Subindex was the dependent variable, none of the variables in this equation were statistically significant. The p-values for all five variables, L_exports (0.633), Difference (0.430), Subindex itself (0.373), Exchange Rate (0.995), and Production (0.735), are well above 0.10. So, there is no clear evidence that any of the previous year's values affect the Subindex in this rice model. In the model where the Exchange rate was the dependent variable, Production (-1) was the only statistically significant variable. The p-value of 0.005 makes the variable significant at the 1 percent level, and the negative coefficient of -0.008 means that when Last year's Production increases by one ton, the exchange rate drops slightly in the current year. However, there is a minimal relationship between these two variables. All other variables, L_exports (0.657), Price_Gap (0.107), Subindex (0.271), and Exchange_Rate itself (0.613), are not statistically significant. Lastly, the present year's rice production is significantly impacted by the past year's Exchange Rate and rice Production. The exchange rate has a p-value of 0.005, making it significant at the 1 percent level. The negative coefficient of -0.008 shows that a weaker rupee reduces future rice production by 0.008 tons. Production (-1) is also highly significant with a p-value of 0.000 and a strong negative coefficient of -0.611, indicating that if last year's Production was high, current Production tends to fall. The other variables, exports, price gap, and Subindex, are not statistically significant in this model.

Table 2. Results for the VAR model with respect to Wheat

	L_exports	Price_Gap	Sub_index	Exchange_ Rate	L_Production
L_exports (-1)	0.554	0.602	-2.206	0.497	0.002
	(0.210)	(0.284)	(4.642)	(0.225)	(0.005)
	0.008***	0.034**	0.635	0.027**	0.757
Price_Gap (-1)	-0.038	-0.084	1.454	-0.205	-0.002
	(0.151)	(0.204)	(3.339)	(0.162)	(0.004)
	0.803	0.682	0.663	0.205	0.521
Sub_index (-1)	-0.025	-0.033	-0.346	0.015	0.000
	(0.009)	(0.012)	(0.201)	(0.010)	(0.000)
	0.006***	0.008***	0.085*	0.125	0.489
Exchange_Rate (-1)	-0.335	-0.065	-9.895	0.033	-0.003
	(0.180)	(0.243)	(3.976)	(0.193)	(0.004)
	0.063*	0.788	0.013**	0.862	0.437
L_Production (-1)	7.324	-27.563	250.478	-0.744	-0.374
	(8.536)	(11.514)	(188.44)	(9.123)	(0.208)
	0.391	0.017**	0.184	0.935	0.072*

*Standard errors in parentheses, and p-value below standard errors; ***p<0.01, **p<0.05, *p<0.1*

Table 2 illustrates the outcomes of the VAR model pertaining to Wheat. The five models are presented, with row 1 illustrating the dependent variables. Three variables are statistically significant for the first model, wherein the dependent variable is wheat exports. The initial variable is L_exports (–1), or the previous year's wheat exports, with a coefficient of 0.554 and a p-value of 0.008, which is highly significant at the 1% level. This means that a 1% increase in wheat exports last year is associated with a 0.55% increase in current exports, showing persistence in wheat trade flows. The second significant predictor is Sub_Index (–1), the lagged sub index, with a coefficient of -0.025 and a p-value of 0.006, significant at the 1% level. This suggests that increasing the sub-index in the previous year can decrease wheat exports. Moreover, the lagged exchange rate has a negative and substantial effect on current exports. Hence, as the exchange rate rises in the last period, the current year's exports fall by 33 percent. The other variables, Price_Gap (p = 0.803) and Production (p = 0.391), are not statistically significant at conventional levels and hence do not affect wheat exports.

Two variables emerge as significant for the model where the dependent variable is Price_Gap. Exports (–1) have a positive and significant effect, with a coefficient of 0.602 and a p-value of 0.034. This suggests that higher exports in the past year widened the price gap between MSP and wholesale prices, likely because export demand tightens domestic supply and raises market prices above MSP.

By contrast, the Sub_index (–1) is strongly significant at the 1% level (coef. –0.033, p = 0.008), indicating that higher international wheat prices reduce the MSP–market price gap by pulling wholesale prices downward toward MSP.

Thereafter, the current year's Wheat Subindex is strongly and significantly influenced by the previous year's SubIndex with a coefficient of –0.346 and a p-value of 0.085, suggesting a small but meaningful persistence effect in international wheat price trends. No other variables were significant in this equation, and thus, other domestic factors such as exports, Production, or the exchange rate do not influence the Subindex.

Moreover, Sub_index (–1) shows a significantly negative impact on the current year's Exchange Rate, with a coefficient of –9.895 and a p-value of 0.013, indicating that rising international wheat prices are associated with an appreciating rupee. This reflects how global commodity price cycles influence India's exchange rate dynamics. However, in this framework, all other variables, including exports, price gap, and Production, are not significant in determining the current period's exchange rate. Lastly, for Wheat's Production, lagged Production (–1) is weakly significant with a coefficient of –0.374 and a p-value of 0.072, at the 10% level. This implies mean reversion in wheat output: years of high Production tend to be followed by lower output the next year, likely due to climatic cycles, soil fertility constraints, or land-use adjustments. Other variables (exports, price gap, Subindex, and exchange rate) were not significant enough to affect wheat production.

4. Discussion

Results obtained under the Vector Autoregression (VAR) model for rice and Wheat highlight two major models: the first model has the dependent variable as exports, and the second model has the differential wholesale price over the Minimum Support Price (MSP). The two models capture the major theme of the present study, examining the interaction between price support policies and trade behavior, and outline the major differences noted between rice and Wheat.

The export model reveals characteristic reversal patterns in the rice series. The lagged export variable has a strongly negative and statistically significant coefficient (−0.585, $p<0.01$), indicating that large rice shipments in one year are usually followed by a decline in the next year. The pattern can be explained by various mechanisms. First, the inventory adjustment mechanism comes into play: in years of large shipments, exporters and the Food Corporation of India run down their inventory levels, so there are fewer stocks available for export in the next year. Second, the various policy measures come into play: the government of India often announces minimum export prices, quotas, or outright bans on rice shipments after years of large shipments in an effort to control domestic food price inflation or to meet the food security commitment. Together, these influence negative autocorrelation in rice shipments, such that large increases are always followed by large decreases.

A further important factor is the gap between wholesale and Minimum Support Price (MSP), which is of significant importance for rice exports (−0.048, $p<0.01$). The definition of the same as Wholesale minus MSP implies that an increasing gap means that wholesale prices are rising at a level higher than the support price. This situation tends to shift rice to the domestic market, where traders find more profitable returns, while also making Indian exports less competitive compared to suppliers like Thailand and Vietnam. Therefore, an increase in the price gap reduces rice exports. This phenomenon is because India's MSP acts as a stabilizing lower limit; however, when wholesale prices rise above the MSP, exporters lose interest in foreign markets because of the higher profitability of domestic sales. In this way, rice exports are extremely sensitive to domestic pricing distortions [51]. On the other hand, the other three variables, Subindex, Exchange Rate, and Production, do not show significance in the rice export equation, which means that short-run domestic environments have a stronger impact on flows of rice exports than external price indicators, currency fluctuations, or harvest levels [52].

Within Wheat, the export model shows a significantly different story. Here, lagged exports are significant and positive (0.554, p = 0.008), implying that once exports have started, they tend to continue. This persistence highlights market continuity and sustained demand. Unlike rice, where exports are more volatile due to tighter consumer substitution and policy shifts, wheat trade relations often take the form of long-term government-to-government contracts or bulk supply deals. When India opens up wheat exports in a particular year, customers from countries like the Middle East and Africa often return the following year, leading to consistent export volumes [53]. Interestingly, both the global wheat price subindex (–0.025, p = 0.006) and the exchange rate (–0.335, p = 0.063) significantly affect exports, suggesting that international price signals and currency movements also shape wheat export outcomes. However, neither the domestic price gap (p = 0.803) nor Production (p = 0.391) significantly drives exports. This indicates that wheat exports are influenced by a combination of persistence, global market conditions, and policy choices. In fact, India has frequently imposed sudden bans and quotas on wheat exports, such as in May 2022 when shipments were suspended to shore up domestic supply during a heatwave. Overall, wheat exports are shaped by government approval and global conditions, but with a strong path-dependency effect from the previous year's trade volumes [54].

A consideration of the price gap (Wholesale − MSP) indicates significant differences between rice and Wheat. In the rice case, three variables show statistical significance. First, the Subindex (−0.156, $p<0.01$) has a negative effect, indicating that higher international rice prices are associated with higher wholesale prices in Indian markets, thus narrowing the Difference between market prices and MSP. This pattern supports India's high degree of integration into international rice markets: rising world prices are quickly translated into higher Indian wholesale prices [12,41,55,56]. Second, the Exchange Rate (−0.695, $p<0.10$) is also seen to have a negative coefficient, indicating that rupee depreciation raises domestic prices of tradables, thus driving wholesale prices towards the MSP and further closing the gap [57]. Third, Production (−36.149, $p<0.01$) shows a significant and negative effect: higher yields at harvest times put downward pressure on wholesale prices, making it difficult to manage the challenges of MSP procurement. At the same time, this scenario may also reduce the price gap due to delays in the adjustment of MSP after production peaks. Together, the results validate that the rice price gap is affected by both international market forces (prices and exchange rates) and movements in Indian harvests, reflecting the vulnerability of rice prices to both international and domestic factors [31,32,58]. Nevertheless, lagged exports and the lagged gap itself are not significant in this equation.

Unlike rice, Wheat's price gap equation shows a more complex dynamic. Here, lagged exports are significant and positive (0.602, $p = 0.034$), suggesting that higher export volumes widen the MSP–wholesale gap, as export demand raises domestic market prices above MSP. The global wheat subindex (–0.033, $p = 0.008$) is also strongly significant and negative, indicating that higher international wheat prices reduce the price gap by pulling wholesale prices closer to MSP. Finally, lagged Production exerts a large and negative effect (–27.563, $p = 0.017$), consistent with the idea that higher domestic output narrows the price gap by lowering market prices through excess supply. In contrast, the lagged price gap and the exchange rate are insignificant, meaning the domestic price wedge is not directly shaped by inertia or currency fluctuations.

This means the wheat price gap is not solely an administrative construct but reflects a combination of policy actions and market fundamentals. Government-determined Minimum Support Prices (MSPs) and open-ended procurement by the Food Corporation of India (FCI) continue to anchor the system, but wholesale prices are also swayed by export demand and global price cycles. Unlike rice, where price gaps are tightly linked to international competitiveness and consumer substitution effects, Wheat's price gap reflects a hybrid mechanism: partly shielded by policy but still sensitive to production shocks and trade flows [44,52,58].

A comparative examination makes the institutional differences clear. For rice, export quantities exhibit a strong correlation with domestic price trends, making them highly vulnerable to MSP distortions and global parity shifts [59]. Wheat, by contrast, remains primarily policy-driven, with export persistence (lagged exports) and production cycles shaping outcomes, while MSP interventions buffer the domestic gap from fully mirroring world prices [12,60]. Rice thus requires careful calibration of MSPs relative to global benchmarks, while Wheat requires greater predictability and transparency in trade policy, since the price gap itself does not consistently guide export flows [61].

5. Conclusion

Agricultural export forms the cornerstone of the Indian economy, particularly for mainstay products like rice and Wheat. The study examines the dynamics between Minimum Support Price (MSP) and wholesale price changes to determine their impact on the export performance of the two agricultural commodities. The study utilizes time-series data for the years 2001-2023 that are sourced from the Commission for Agricultural Costs and Prices (CACP) for MSP, the Ministry-run AgriExchange portal for export data, and the Agricultural Statistics at a Glance by the Ministry of Agriculture for Production and price data. The study uses trend analysis and Vector Autoregression models to identify the dynamics between the variables.

The trend analysis shows that the price gap between MSP and wholesale prices widened steadily over time for both rice and Wheat. For rice, the gap grew from about –30 in the early 2000s to nearly –100 by 2023, showing that MSPs consistently outpaced wholesale prices. Wheat's gap rose even more sharply, crossing 120 by 2023, reflecting continuous MSP hikes. In contrast, export values were highly volatile: rice exports stayed flat until 2010 but peaked during 2011–13 and again in 2020–21, before falling after 2021. Wheat exports remained negligible until 2010, spiked in 2012 and 2020, but dropped sharply after the 2022 export ban.

The findings based on Vector Autoregression (VAR) estimation reveal that rice exports are significantly affected by both past export levels and the price gap. Past export levels have a negative effect, implying that higher exports in one year may reduce exports in the following year due to depleting stock or stringent governmental controls. In addition, the price gap negatively impacts rice exports since wider gaps make Indian rice less competitive in the global market. On the other hand, wheat exports are only affected by lagged export quantities, which have a positive relationship, implying sustained demand following the establishment of export channels. Interestingly, parameters like the price gap, production levels, exchange rates, and the global price index (Subindex) have no significant impact on wheat exports. The framework wherein the price gap is the dependent variable, rice shows strong sensitivity to global and domestic factors: the global price index narrows the gap, rupee depreciation reduces it further, and higher Production significantly lowers wholesale prices, widening the gap against MSP. For Wheat, however, a few variables significantly affect the price gap, including exports, the sub-index, Production, and the impact on the current price gap, confirming that it is primarily policy-driven through MSP announcements and procurement rules rather than market forces.

The findings indicate that rice exports are highly sensitive to both pricing distortions and policy interventions, while wheat exports are shaped more by government trade decisions and demand persistence. Rice requires careful alignment of MSP with global prices to preserve competitiveness, whereas Wheat needs a consistent and predictable export policy. Policymakers must take crop-specific approaches; MSP increases that exceed market growth can damage competitiveness, particularly for rice, and a responsive, flexible trade policy is needed to underpin balanced growth.

6. Limitations and Policy Implications

One key limitation of the study is that it relies exclusively on secondary data and lacks primary data from farmers, government procurement officials, or exporters, which would provide a more on-the-ground perspective. The period considered, 2000 to 2025, is useful but can be extended to 30–50 years for more statistically significant time series modeling. Another limitation is the limited crop choice. MSP is announced for more than 20 crops in India, yet this paper examines only rice and Wheat, and it is not easy to generalize findings to others, such as pulses, oilseeds, or cotton. Likewise, since this study examines only India, the findings cannot be extended to other farm economies. Further, the framework did not incorporate macroeconomic shocks such as COVID-19 or the Russia–Ukraine conflict, although these have significantly affected trade and prices. These gaps modestly limit the conclusions and underscore the need for future work involving additional variables and angles.

Despite these limitations, the study is relevant to policy. The findings can help government policymakers, farmer cooperatives, trade analysts, and NGOs understand the conditions under which MSP begins to make exports unviable, particularly in rice, where export competitiveness is highly sensitive to pricing distortions. This knowledge can guide the design of more balanced procurement and pricing policies. NGOs and farmer advocacy groups can use the insights to push for more equitable support systems, ensuring that MSP benefits are distributed more evenly across states and farmer groups, rather than being concentrated in surplus-producing regions such as Punjab. Exporters and commodity boards can utilize the findings better to anticipate fluctuations in export performance under different price-gap scenarios and adjust their trade strategies, contracts, and global marketing efforts accordingly. Finally, the government could adopt a more flexible and region-sensitive MSP approach that protects farmer incomes while ensuring global competitiveness, with better coordination between procurement and trade policy to achieve India's twin food security and export growth goals.

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