MITIGATING THE IMPACT OF PRICE INSTABILITY ON POVERTY IN PAKISTAN:

THE EFFECTIVENESS OF PUBLIC GRAIN STOCKS AND PRICE STABILIZATION POLICY

The World Bank

December 2014

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Final Report submitted to

The World Bank

Washington, D.C.

December 2014

Contents

Acronyms

API: Agriculture Policy Institute, Islamabad.

CPI: Consumer Price Index

FY: Fiscal year in Pakistan, from July 1st to June 30th

GTIS: Global Trade Information Services (Inc.)

IGC: International Grain Council

MY: Wheat crop marketing year in Pakistan, from May 1st until April 30th

NRA: Nominal Rate of Assistance

PASSCO: Pakistan Agricultural Storage and Services Corporation

TCP: Trading Corporation Pakistan

Acknowledgements

This report was written for the World Bank as a Poverty and Social Impact Study: Mitigating the Impact of Price Instability on Poverty in Pakistan: The Effectiveness of Public Grain Stocks and Price Stabilization Policy.

The authors of chapters one, three and four are Johan Swinnen and Elena Briones Alonso. The second chapter was written by Garry Christensen. Appendix 3 was written by Evgeny Polyakov.

The authors are further grateful for the excellent guidance and comments of Bekzod Shamsiev. The authors would also like to thank Paul Dorosh, Director of the Development Strategy and Governance Division, IFPRI, for the provision of data, many valuable comments and crucial input for chapters three and four.

Dmitry Prikhodko, Economist, Europe, Central Asia, Near East, North Africa, Latin America and the Caribbean Service, Investment Centre Division, Technical Cooperation Department of the Food and Agriculture Organization of the United Nations (FAO) has been consulted on matters related to trade in grain and grain products.

Executive summary

Rural poverty and food security are major concerns for Pakistan, and wheat is the most important agricultural crop and staple food. Both farmer income and food security are to a large extent associated with wheat production and consumption, in particular among the poor.

The wheat market continues to be heavily controlled by the government through the wheat price stabilization policy. The main objectives of this program are (1) to ensure the availability of wheat flour at affordable prices to urban areas and (2) to help provide sufficient incentives and incomes to wheat farmers to encourage production and limit reliance on imports. The main instruments used to achieve these objectives are: (1) trade policies, (2) wheat procurement at support prices, (3) sales of wheat to flour millers at below-market rates and (4) ceiling prices for wheat flour sales.

The current policy system is criticized for several reasons (Dorosh and Salam, 2008; International Finance Corporation, 2011; Prikhodko and Zrilyi, 2013; World Bank, 2010). The policy is argued (a) to have a high and unsustainable cost of maintaining the current price structure, (b) to stifle private sector commodity markets (c) to have weakened the banking system and (d) to provide little benefit to smallholder farmers who dominate agriculture and account for a high proportion of the rural poor.

This report aims to assess the degree to which Pakistan's Wheat Price Stabilization Program is effective and efficient in mitigating the impact of price instability on poverty.

The second chapter addresses the first critique by analysing the public costs of Pakistan's wheat-flour policy for the period 2000-2012 for the Punjab province. The analysis indicates that program expenditure for Punjab in absolute numbers was low in fiscal years 2002 - 2008, increased considerably in response to the global 2007/08 food price spike and fell again to more moderate levels in recent years (fiscal years 2011 and 2012). The major sources of increased program costs for Punjab since fiscal year 2009 are high carry-over stocks and high associated interest costs.

The analysis further finds that, while aggregate public expenditure on the program is low as a proportion of total public expenditure, it is high relative to the budget allocations for federal and provincial expenditure on agriculture and to expenditure on agriculture research. In addition, both the IMF and the State Bank of Pakistan have expressed concern that the mounting costs of the wheat price stabilization program, and the reliance on commercial bank credit to finance these costs, is crowding out private sector credit and adding to "quasi-fiscal pressures".

Our econometric analysis does not find a strong impact of government wheat releases on price dynamics (see Appendix 3 of the report), weakening the case for existing policies. The analysis of market co-integration does show a geographically clustered market co-integration with two geographical clusters, and shows that markets are strongly co-integrated vertically within value chains (wheat-flour and rice). This

somewhat expected result also weakens the rationale and justification for government intervention on commodity markets.

These findings highlight the need to rationalize expenditure on what is ultimately an untargeted subsidy program, with a growing public cost and a growing impact on commercial bank lending.

The third chapter of the report examines the welfare implications of the wheat price stabilization policy for various interest groups along the wheat (flour) value chain for the years 2000 – 2013, a period characterized by regular adjustments of domestic policies and major price volatility in global wheat (flour) markets. The authors calculate rent distributional effects of the wheat-flour policy for wheat farmers, wheat traders, flour millers and flour consumers using an adjusted Nominal rate of Assistance (NRA) methodology.

The NRA is mostly used to calculate the welfare effects of government interventions for farmers and consumers. In our study, we extend the methodology and its application to measure disaggregated rent distributional effects for various agents in the wheat (flour) value chain. The analysis aims to measure who is benefitting from the wheat price stabilization policy and who is losing.

The disaggregated NRA analysis of Chapter 4 indicates that wheat-flour policies have generally benefitted flour consumers and wheat traders at the expense of wheat farmers (and to a lesser extent flour millers). In recent years, however, distortions have notably declined and farmer taxation is close to zero.

Farmers were taxed as the price they received for wheat sales was lower than the hypothetical undistorted market price, both when traders pay farmers the support price and when they pay farmers the wholesale wheat price minus trader marketing costs. Flour consumers were subsidized as domestic retail prices of wheat flour were kept below the undistorted market price. Wheat traders generally benefitted from the policies, whereas flour millers were on average taxed. Both agents were subsidized on the "input side" and taxed on the "output side". For wheat traders the subsidy to wheat purchases was larger than the tax on wheat sales. For flour millers the tax on flour sales on average exceeded the subsidy to wheat purchases. Nevertheless, the net effect on flour millers varies significantly across periods and amounts to a modest subsidy in several years.

During the 2007/08 food price shock, the export ban in combination with large-scale public imports at below-market rates caused a particularly heavy taxation of farmers, who were not able to profit from the spike in international wheat prices. This is reflected in the NRA to wheat farmers, which reached a minimum of - 24 % to - 37 % in 2007/08, depending on assumptions regarding the farmgate price. On the consumer side, domestic consumer prices were kept far below international flour prices. This is reflected in a large and positive consumer NRA of 22 % to 27 % in 2007/08, depending on assumptions about border prices. Government policies during the food price spike thus protected flour consumers from the negative consequences of the food price shock, but at a large cost to farmers. Wheat traders similarly continued to be subsidized during the food price shock at the expense of wheat farmers.

From late 2010 onwards, the export ban on wheat (flour) was lifted and public and private wheat (flour) exports surged, causing domestic wheat prices and export parity prices to converge. As a result, farmer taxation decreased considerably: the NRA to farmers moved from large negative numbers to NRAs close to zero. The subsidy to wheat traders similarly fell close to zero. Flour consumers continued to be subsidized on average, although the monthly NRAs exhibited large fluctuations and subsidization remained around 10 %. Flour millers continued to be taxed, but the tax falls below 10 %.
The findings of Chapter 3 suggest that the wheat price stabilization policy succeeded reasonably well in one of its main objectives, namely ensuring affordable flour prices for consumers, but fails to meet the second objective of supporting farmer incomes. In addition, the achievement of domestic price stability and affordable prices has entailed substantive budget costs, as indicated by the findings in Chapter 2. Finally, wheat traders are found to capture a significant part of the policy rents, which represents an efficiency loss as the policy does not aim to support this group.

The implications of the findings summarized above point towards several recommendations for policy reforms that could improve the efficiency and effectiveness of the wheat price stabilization policy.

During the 2007/08 food price spike, the export ban and large-scale public imports succeeded in keeping domestic prices in check but created significant distortions. The subsequent liberalization of wheat (flour) trade and export promotion since late 2010 reduced the substantive distortions created during the 2007/08 food price shock at the benefit of farmers, without endangering domestic price stability.

This finding leads to the first recommendation for policy reform: price stability should be promoted mainly through the use of international trade, accompanied by an explicit commitment of the government to promote private wheat (flour) trade. In years of high world prices – like the 2007/08 price spike – the government could temporarily resort to export restrictions and wheat transfers sourced from public imports or a limited national security stock to prevent domestic prices from rising excessively.

The use of international trade to promote price stability may be complemented by targeted wheat transfers to food insecure and vulnerable households from a limited national security stock. This strategy may be warranted in years of high international prices and insufficient domestic production – to keep domestic prices in check– or when emergency wheat distribution is needed, e.g. in the wake of natural disasters.

A second important area of reform is the current system of domestic wheat procurement and releases. The procurement system is not benefitting farmers compared to a no-intervention scenario. In addition, Chapter 2 has found that high carry-over stocks are one of the major causes of the elevated budget costs of the program. It is therefore advisable to gradually reduce domestic wheat procurement and commit to procuring limited quantities either at domestic market prices or at a suitable pre-announced support price.

One possible objection regarding this proposed reform concerns the redistribution purposes of government procurement and releases (e.g. from wheat surplus to deficit regions). However, redistribution could be more efficiently achieved through the private market when combined with improved targeted subsidy programs and safety nets. As the current procurement-release policy amounts to an untargeted subsidy program with unsustainable public costs, and the effectiveness of subsidized wheat sales through the Utility Stores Corporation system has been questioned, this strategy could present a more effective and efficient way of improving access to affordable wheat (flour) for poor and food insecure households.

An abandonment of the procurement policy does not entail an abandonment of farmer support. Farmer incomes could be more effectively and efficiently supported by various alternative policies, e.g. investment in rural infrastructure, improved storage facilities and agricultural research and extension. The reduction or elimination of the current procurement policy could free up valuable resources for increased investments in these areas.

1. Introduction

Rural poverty and food security are major concerns for Pakistan. A World Bank (2010) study stated that 17 to 38 % of the population is classified as poor and 56 % is considered vulnerable, i.e. being poor or likely to become poor after a shock. According to the FAO Food Security statistics, 17.2 % of the population was undernourished in Pakistan in 2011-2013; in 2011, 43 % of children under five were affected by stunting and 15 % by wasting.

The most important agricultural crop and staple food in Pakistan is wheat. Grown by 80 % of farmers on roughly 40 % of the country's total cultivated land, wheat alone contributed about 10 % to value added in agriculture and 2 % to GDP in 2013 (USDA, 2014). Wheat flour consumption per capita in Pakistan is currently one of the highest in the world, with wheat flour accounting for about 37 % of daily caloric consumption (Prikhodko and Zrilyi, 2013). Hence, both farmer income and food security are to a large extent associated with wheat production and consumption, in particular among the poor.

The wheat market continues to be heavily controlled by the government through the wheat price stabilization policy. The main objectives of this program are (1) to ensure the availability of wheat flour at affordable prices to urban areas and (2) to help provide sufficient incentives and incomes to wheat farmers to encourage production and limit reliance on imports. The main instruments used to achieve these objectives are: (1) trade policies, (2) wheat procurement at support prices, (3) sales of wheat to flour millers at below-market rates and (4) ceiling prices for wheat flour sales.

Several reports and articles describe the wheat-flour market and wheat price stabilization policy in Pakistan.[1] Wheat in Pakistan is mainly produced in the Punjab and Sindh province: in the period FY1992 – FY2012 Punjab accounted for 76 % and Sindh for 14 % of national wheat production.[2] The remaining 10 % is produced in Khyber Pakhtunkhwa and Balochistan. Wheat is grown primarily by small (0.5 to 5 ha) and medium-sized (5 to 10 ha) farmers. On average, about 40 % of production is retained at the farm for seed, in-kind labour payments and household food consumption. As a result, about 60 % of wheat production enters the market (Dorosh and Salam, 2008; (International Finance Corporation 2011); Prikhodko and Zrilyi, 2013).

Since the 1960s, the wheat market has been heavily controlled by the government through the Wheat Price Stabilization Program, which entails both domestic market interventions and trade policies.[3] The government procures wheat from farmers at the *support or procurement price* and sells procured wheat to flour millers at the *release or issue price*. Government wheat procurement at the support price is intended to increase

[1] This section draws heavily from Dorosh and Salam (2007), Dorosh and Salam (2008); International Finance Corporation (2011); Lohano, Smith, and Stockbridge (1998); Prikhodko and Zrilyi (2013). See also for instance Ahmad, Qayyum, and Iqbal (2005); USAID (2009) and Zahid et al. (2007).

[2] Author's calculations based on data from Pakistan Bureau of Statistics.

[3] Trade policies are discussed in more detail in section 3.

wheat production and support farmer incomes. Increasing domestic wheat production has also been seen as a means of improving overall national food security by limiting the reliance on wheat (flour) imports. The distribution of wheat to flour mills at the subsidized release price and the formulation of ceiling prices for ex-mill wheat flour are intended to ensure the availability of wheat flour at affordable prices to urban areas and to maintain price stability. Imports of wheat, undertaken only by the federal government, have been used to supplement domestic production with the aim of stabilizing domestic supply and prices.

Both the support and release price and procurement targets are set by the federal government in consultation with provincial governments. The support price holds throughout the season, whereas the release price may be adjusted during the marketing year. [4] Both prices are pan-territorial and hold throughout the country. The implementation of the procurement policy is the responsibility of provincial governments and PASSCO, while wheat releases in Punjab and Sindh are largely the responsibility of provincial governments.[5] Since the 2000s, the government has been procuring on average about 40 % of the marketable surplus, or 23 % of national production.

The main buyers of wheat are the government and private sector wheat traders. Provincial Food Departments purchase wheat from farmers after the wheat harvest at the support price until procurement targets are met. [6] The support price is intended to support farmer incomes by protecting farmers from the depression of market wheat prices in the months following the harvest. Figure 3.1 shows the monthly support price and an estimated market farmgate price, calculated as the Lahore wholesale wheat price minus trader marketing costs, in real terms for 1991-2013. There is a clear seasonal fluctuation in the wholesale wheat price, which drops in post-harvest months and increases again towards the end of the calendar year. As can be seen from Figure 3.1, in the second half of the 1990s and in some years in the 2000s (f.e. 2004-2006 and 2008) this estimated market farmgate price exceeded the support price throughout the year. In the early 1990s and most of the 2000s the support price was higher than or equal to the estimated farmgate price in post-harvest months.

To ensure that Food Departments meet their targets, a ban may be placed on inter-provincial wheat trade. In general, the private sector is not allowed to engage in large-scale wheat purchases and storage until government procurement has ended. However, exceptions are made for flour mills – the major processors of wheat – and local traders, known as Aarthis and Beoparis.

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[4] In some years, the support price was revised during the wheat marketing year as well. In years where the support or release price was adjusted during the marketing year, we have used the average support/release price across the year in the analysis.

[5] PASSCO is a federal institute responsible for nation-wide procurement and distribution of wheat and is specifically in charge of supplying wheat to deficit zones (i.e. Balochistan and Khyber Pakhtunkhwa) and to the military forces.

[6] The wheat crop marketing year runs from May to April the following year. Most wheat in Pakistan is harvested in March and April and sowing takes place in September-December.

Beoparis are village traders that are in direct contact with farmers and are responsible for wheat purchases at the farmgate. Aarthis are commission agents that deal in large quantities of wheat and contract Beoparis to assemble these quantities. Wheat purchased at the farm by Beoparis is packed and delivered to the Aarthis, who sell the assembled quantities on the wholesale market to flour millers or stockists. Most small and medium-sized farmers sell their produce to wheat traders; self-marketing is only a marginal phenomenon. This may be partly explained by the fact that farmers then do not need to concern themselves with the logistics of wheat marketing such as arranging bags, handling and transportation (International Finance Corporation, 2011). Another explanation is the prevalence of interlinked contracts, where traders provide farmers with credit and inputs and farmers repay debts in kind or by selling wheat at a discounted price (International Finance Corporation 2011); Prikhodko and Zrilyi, 2013).

According to reports by the International Finance Corporation (2011a; 2011b), until 2008 the government procured wheat through wheat traders. After 2008, the involvement of wheat traders was banned out of concern that farmers were not receiving the support price. However, it is not clear how well this measure is enforced: in Sindh, wheat traders appear to continue being involved in wheat procurement for the Sindh government.

Procured wheat, possibly supplemented with public wheat imports, is sold to flour mills at below-market rates, i.e. the release price. Wheat releases occur mainly from October until the next wheat harvest (when wheat shortages drive up market prices), although provincial Food Departments release wheat to mills throughout the marketing year as needed. Large (urban) mills tend to supplement government wheat by wheat purchases on the open market. The release of wheat to flour mills is determined by a quota system, where quotas are in theory based on milling capacity, but in practice may depend on other factors such as the political influence of the owner. The price of ex-mill flour processed from subsidized wheat is regulated by the government through ceiling prices, so as to pass on the wheat subsidy to flour consumers in the form of lower consumer prices. However, Dorosh and Salam (2008: 76) argue that: "[a]lthough there may be a stipulated sales price of flour, there is no effective enforcement mechanism. Since wheat flour produced from government wheat is not distinguishable from wheat flour produced from market wheat, their prices are the same." (see also (International Finance Corporation 2011) and Prikhodko and Zrilyi, 2013). Flour mills that receive subsidized wheat from the government can therefore enjoy massive profits from sales of subsidized wheat flour at market prices. As such, the release policy by quotas offers considerable opportunities for rent-seeking (see for example Lohano, Smith, and Stockbridge (1998) and Ahmad, Qayyum, and Iqbal (2005)) and has resulted in a considerable excess capacity in the flour milling industry, with part of the mills operating only in the 4-6 month pre-harvest period (November – April) and milling exclusively government wheat (Dorosh and Salam, 2008; Prikhodko and Zrilyi, 2013).

The government also sells wheat flour at subsidized prices to consumers through the Utility Stores Corporation system (USC). According to the World Bank (2010) and Khan and Shah (2011), the Utility Stores Corporation was established in a reaction to the food crisis and has rapidly expanded into thousands of outlets. According to FAO et al. (2008), Utility Stores sell wheat flour at prices that are 10 to 20 percent lower than

market prices. However, a World Bank (2010) report questions the effectiveness of these Utility Stores, as the geographical coverage is limited, there is no targeting and the amount allowed per family is only 5 kg/month compared to an average per capita wheat consumption of around 10.5 kg per person per month .[7] The report by FAO et al. (2008) similarly indicates that Utility Stores face problems of queues, long waiting hours and unreliable supply.

This policy system is criticized for several reasons (Dorosh and Salam, 2008; International Finance Corporation, 2011; Khan and Burki, 2005; Prikhodko and Zrilyi, 2013; World Bank, 2010). The policy is argued (a) to have a high and unsustainable cost of maintaining the current price structure, (b) to provide little benefit to smallholder farmers who dominate agriculture and account for a high proportion of the rural poor, (c) to have weakened the banking system and (d) to stifle private sector commodity markets.

Regarding the last point of critique, Khan and Burki (2005) and Prikhodko and Zrilyi (2013) for instance discuss how the procurement and release policy create major disincentives for private sector agents (traders, flour millers and others) to invest in improved wheat storage, as the government wheat sales price (release price) does not reflect procurement, financing and storage costs. Similarly, the policy of covering wheat transportation and the ban on internal wheat trade during the procurement season stifle private sector incentives to invest in improved trading infrastructure. Khan and Burki (2005) also argue that the ban on internal trade of wheat during the procurement season is counterproductive to food security and farmer incomes, as the private sector is unable to move wheat from surplus regions to deficit regions and the government cannot fully or adequately take over this task.

Given the substantive criticism regarding Pakistan's wheat price stabilization policy and the recent shocks to world food supplies and food prices, a more rational price policy stance is being sought (Christensen, 2013a).

This report aims to assess the degree to which Pakistan's Wheat Price Stabilization Program is effective and efficient in mitigating the impact of price instability on poverty. The second chapter focuses on the efficiency aspect and analyses the public costs and sustainability of the current policy structure. Chapter three focuses on the effectiveness dimension and examines the welfare implications of the policy on various interest groups along the wheat (flour) value chain for the years 2000 – 2013, a period characterized by regular adjustments of domestic policies and major price volatility in global wheat and flour markets. Chapter four summarizes the findings and offers some recommendations for establishing more efficient, cost-effective and less distortionary policies to mitigate the impact of price instability on the poor in Pakistan.

[7]Assuming an average per capita consumption of 126 ks/person/year since 2007/08 (calculated from data supplied in Prikhodko and Zrilyi (2013).

2. Public Expenditure Trends and Characteristics

2.1. Introduction

This chapter examines public expenditure on Pakistan's Wheat Price Stabilization Scheme for the period 2000-2012. Aggregate data are drawn from the Agriculture Policy Institute of Pakistan, The State Bank of Pakistan, The Statistical Yearbook of Pakistan, FAOSTAT, the World Bank Development Indicators and country reports of the IMF. Further, disaggregated data were drawn from the Punjab Food Department. Unless stated otherwise, annual data refer to the fiscal year July 1st-June 30th used as the basis for reporting in Pakistan (e.g. FY2000 refers to the period 1999-2000).

2.2. Trends in Aggregate Expenditure

Aggregate expenditure on this program is reported by the Agriculture Policy Institute of Pakistan. This expenditure includes: losses incurred as a result of the purchase and re-sale of domestically procured wheat, the net costs of wheat imported/exported to manage public stocks and the costs of program administration and management (procurement, storage, handling and sale of publicly procured wheat). As shown in Table 2.1 below, these costs varied significantly for the period FY2000-FY2012, both in absolute terms and as a proportion of public expenditure.

In $US the total cost ranges from $774 million in FY2008 to zero in FY2005. The highest costs were incurred in FYs' 2008 and 2009 when wheat was imported in response to the global food price crisis. A more stable pattern of expenditure has occurred since FY2010, with annual costs of $US209-259 million. Although high in absolute terms, this level of expenditure is modest as a percentage of total (current) budget expenditure and as a percentage of total budget expenditure on transfers and subsidies8. Program expenditure amounted to 2-3% of current budget expenditure at its peak during the global food crisis, but has since fallen to less than 1% of current budget expenditure. A significant increase in government's total budget expenditure on transfers and subsidies since FY2001 has also lowered the program's share of overall subsidies and transfers. It peaked at 10-11% of subsidies and transfers during the global food crisis but has since fallen to 2-3%.

A comparison of public expenditure on wheat price stabilization with other elements of public expenditure on agriculture provides further insight. Program expenditure is high relative to budget expenditure on agriculture. Total federal (non-development) expenditure on agriculture, food, irrigation, forestry and fishing for FY2012 was 12.11 billion Rupees (Table 2.2), versus the 19.53 billion Rupees spent on wheat price stabilization. For federal and provincial government expenditure combined, wheat price stabilization expenditure was equivalent to 31% of non-development expenditure and 20.3% of total public expenditure on agriculture.

[8] Comprises subsidies, grants and other social benefits, including all unrequited, non-repayable transfers on current account to private and public enterprises; grants to foreign governments, international organizations and other government units; and social security, social assistance benefits and employer social benefits in cash and in-kind.

A recent analysis of agricultural research spending in Pakistan (IFPRI, 2012) shows expenditure of 5.24 billion Rupees in FY2009, which is approximately 25% of the average annual expenditure on wheat price stabilization for the period FY2010-FY2012. The IFPRI analysis also notes that Pakistan's agricultural research spending is amongst the lowest in South Asia, and suggests that such low research expenditure contributes to Pakistan's low agricultural productivity.

Hence, while public expenditure on wheat price stabilization is low as a proportion of total public expenditure, it is high relative to other critical elements of public expenditure on agriculture.

2.3. Trends and Characteristics of Program Expenditure – Punjab Province

Lack of data precluded a detailed examination of program expenditure for the country as a whole. Analysis was thus restricted to program costs for Punjab province, where relevant data were more readily available. Punjab accounts for approximately 75% of total wheat production in Pakistan and 50-60% of domestic wheat procured. The Wheat Price Stabilization costs incurred for Punjab are also viewed as similar to those incurred by Sindh province, which accounts for a further 15% of wheat production and 20% of domestic wheat procurement. The remaining program costs are incurred by PASSCO, which operates on a somewhat different basis as it supplies procured wheat to public institutions.

Three aspects of Punjab's program expenditure were examined: the costs incurred through the public purchase and resale of wheat, including imports and exports; the operational costs of managing these transactions; and the extent to which carry-over stocks and interest contribute to these costs. Full results of this analysis are presented in Annex 1.1 and 1.2 of Appendix 1, together with the methodology and assumptions used. Note that as the methodology used by the Agriculture Policy Institute of Pakistan could not be verified, there is no way of knowing whether the aggregate analysis presented in the preceding section is consistent with the more disaggregated analysis prepared for Punjab.

Comparison of the purchase (procurement) and sale (release) prices for wheat show that in most years there is a small profit margin of 500-1000 Rupees/mt (Annex 1.1). In the years from FY2002-FY2008, this margin plus full turnover of a modest procured volume meant that net program costs for the Punjab were low. As shown in Figure 2.1, revenues were sufficient to cover most costs. In fact the program appears to have generated a small "profit" in FY2003, FY2004 and FY2007, illustrated in Figure 2.1 as "negative" costs. Modest levels of imports and exports during this period, to complement procurement and release, did not alter this outcome.

Program costs rose dramatically in FY2009 and FY2010 due to: an imbalance between wheat procurement and release volumes, and the consequent need to carry forward a high level of stocks; and an average release price in FY2009 that was well below the procurement price. Program costs returned to more acceptable levels in FY2011 and FY2012 when a better balance was achieved between the volume of purchases and releases, and a margin of approximately 1000 Rupees/mt was re-established between procurement and release prices. Figure 2.2 shows the relationship between net program costs and carry-over stocks, indicating the extent to which high carry-over stocks contribute to higher net program costs.

Further insight is derived from comparison of the two main components of program costs – net procurement costs (domestic procurement + imports – releases – exports), and program operating costs (transport, storage, handling, administration, finance etc). Figure 2.3 shows that the contribution of net procurement costs varies widely from year to year, depending on whether sales and purchases generate a trading profit or a loss. When procurement costs are high, due to a significant trading loss (e.g. FY2009, FY2010), net procurement costs are the major component of net program costs.

This analysis also shows that program operating costs have increased considerably since FY2010, and have become the major element of net program costs since FY2011. (A trading surplus in these two years resulted in "negative" net procurement costs). A breakdown of unit program operating costs (Figure 2.4) shows that a huge (500%) increase in interest costs explains much of this change in the level of net program expenditure. (A full breakdown of these costs is presented in Annex 1.2). Apart from a spike in the costs of bags, transport and handling in FYs 2008 and 2009, the other costs of program operation have remained quite low and constant.

As interest rates have fallen since 2008 (Figure 2.5), the higher interest costs are attributed to increased borrowing from commercial banks to finance the stabilization program. This view is supported by data reported by the State Bank of Pakistan (SBP), which shows a significant increase in total government borrowing from commercial banks for the wheat commodity program since 2009 (Figure 2.5). The higher level of stocks carried forward annually by the program since FY2009 has undoubtedly contributed to this increase in borrowing. It is also possible that program losses are being rolled over as part of this debt, rather than being financed from budget revenues. The IMF alludes to this latter issue in recent reports. The Country Report of May 2010 (No 10/158) notes that, "Wheat procurement and other commodity operations have added an estimated 0.2% of GDP to quasi-fiscal pressures on account of losses incurred by public procurement agencies. And the State Bank of Pakistan remains concerned about lending for commodity operations crowding out credit to the private sector." The country report also notes that the outstanding stock of commodity credits at commercial banks in March 2010 had doubled relative to March 2009 and was equivalent to 2% of GDP. Data from the SBP show that the debt attributable to wheat operations accounts for 75%-80% of this debt. In 2013, the IMF further iterated its concern that "budget support provided by the banking system" was crowding out private credit (Country Report 13/287, September 2013). This report also notes the need to address the problems caused by "costly and poorly targeted subsidies."

3. The Impact of Government Policies and Global Price Volatility on Pakistan's Wheat-Flour Value Chain

3.1. Introduction

This chapter examines the impact of Pakistan's wheat price stabilization policy on the value chain of wheat and wheat flour. We calculate the welfare implications of this policy and of wheat (flour) price volatility for various agents in the chain for the years 2000 – 2013, a period characterized by major price volatility in global wheat and flour markets and by regular adjustments of domestic policies.

The chapter is organized as follows. Section 3.2 describes the wheat price stabilization policy and the value chain for wheat and flour in Pakistan. Section 3.3 quantifies domestic and international price volatility and describes the domestic wheat and flour market by discussing the evolution of international and domestic wheat and flour prices, wheat (flour) trade and wheat production, procurement and releases in Pakistan. Section 3.4 describes the methodology of the Nominal Rate of Assistance (NRA), presents the value chain analysis and discusses the results. Section 3.5 summarizes key findings.

3.2. International and domestic prices, trade and the wheat (flour) market in Pakistan

In contrast to the wheat market, government intervention in the rice market in Pakistan has been limited (Prikhodko and Zrilyi, 2013). Figures 3.2 and 3.3 show monthly international and Pakistan wheat and rice prices for the period 1994-2013 and illustrate that Pakistan rice prices have been more correlated with international prices compared to wheat prices. The correlation coefficient for rice is 91 %, while it is 77 % for wheat. In addition, Pakistan wheat prices have exhibited less volatility compared to international wheat prices, whereas Pakistan rice prices have been more volatile than international prices. For wheat, the coefficient of variation of the monthly international price is 0.39, compared to 0.32 for Pakistan prices. For rice, the coefficient of variation is 0.43 for international prices and 0.49 for Pakistan prices.

However, a comparison of monthly domestic wholesale prices with monthly import and export parities for wheat measured in Pakistan Rupees (C&F and FOB Karachi) shows that domestic wholesale prices have been equally volatile as import and export parities in 1991-2013, with a coefficient of variation of 0.70 for domestic prices versus 0.70 and 0.71 for import and export parities. In contrast, the support and release price set by the government have been slightly more volatile than import/export parity prices: the coefficient of variation for 1991-2013 was 0.76 for the support price and 0.73 for the release price.

The remainder of this section discusses the evolution of international and domestic wheat and flour prices, wheat (flour) trade and wheat production, procurement and releases in Pakistan since the early 1990s. Figure 3.4 shows the evolution of real domestic wheat prices, the real import and export parity price for wheat and wheat (flour) trade since 1991. Figure 3.5 shows wheat production, procurement and releases in Pakistan since 1990/91. Finally,

Figure 3.6 shows real import and export parity prices for wheat flour, real domestic wheat and flour prices and wheat flour trade since 2000.[9]

The 1990s

Throughout the 1990s, Pakistan was a wheat-deficit country with domestic production typically accounting for about 90 % of availability. Hence, under free trade Pakistan would have imported wheat and domestic prices would have been close to import parity prices. However, the government controlled wheat trade through the Trading Corporation of Pakistan and did not allow private sector wheat imports in the 1990s (Prikhodko and Zrilyi, 2013). Public wheat imports were larger than what would have been imported under free trade and were mainly responsible for driving wheat prices in Pakistan below import parity prices.

Retail wheat flour sales, which were controlled by the government in the 1970s through ration shops with fixed prices, were liberalized in 1987/88 when the ration shop system was abolished (Dorosh and Salam, 2008).

The first half of the 2000s

In 2000/2001, the export parity price of wheat started to increase compared to the late 1990s and remained on a higher level throughout the period. As the level of domestic wheat prices remained relatively stable until July 2003, the gap between export parity and domestic wheat prices narrowed. Following a bumper harvest in April 2000 of 21 million tonnes, public imports fell to low levels. Record levels of procurement at 8.5 million tons raised government wheat stocks to high levels, and the government resorted to subsidizing public and private exports of wheat (in the years 2000/01-2003/04).

Private sector wheat flour exports increased significantly in the 2000s compared to the 1990s. Afghanistan has traditionally been the main destination of wheat flour exports from Pakistan. According to trade statistics from the Comtrade database (UN 2014), in the period 2003-2013 over 90 % of Pakistan wheat flour exports flowed to Afghanistan.[10] Historically, Pakistan has been the dominant supplier of wheat to Afghanistan, covering 65 percent of Afghanistan's import requirements (USDA, 2012a). Kazakhstan generally supplies 20 percent of Afghan imports, mostly to the north of Afghanistan. In years when Pakistan placed an export ban on wheat (flour), Kazakhstan took over as the major supplier of wheat and wheat flour to Afghanistan.

As a result of the absence of large-scale public imports and the jump in public and private sector exports, Pakistan became a net wheat exporter in the early 2000s.[11] Even after the government imposed an export ban on wheat (flour) in 2003, wheat (flour) exports

[9] Real prices are expressed in 2005 Rs/kg and are calculated by deflating nominal prices using the monthly Pakistan CPI (base year 2005).

[10] The exception is 2011, when the share was 75 %. In this year, 20 % of exports flowed to the United Arab Emirates.

[11] When referring to net imports and exports, we take into account both wheat and wheat flour trade. Wheat flour imports and exports are converted to wheat equivalents using an extraction factor of 0.77. This rate is calculated by taking a simple average of the extraction rate of Atta (82 %) and Maida (72 %) flour (Tayyab, 2013; USDA, 2012b). Wheat flour imports mostly involve humanitarian aid and food aid (Prikhodko, 2013).

continued to exceed wheat (flour) imports (Persaud, 2013). The only exception is 2005/06, when wheat imports more than doubled compared to the early 2000s in spite of the good 2005 wheat harvest. This jump in wheat imports was likely driven by the combination of (1) the severe earthquake that hit Pakistan in October 2005 and (2) the liberalization of private sector imports in mid-2005, amongst others by removing the tariff on wheat imports (Dorosh and Salam, 2008).

In spite of the 2000 bumper harvest, net availability in 2000/01 was at 109 kg/ capita, a 15 % decrease compared to the previous year. This decline can be explained by record levels of government procurement at 8.5 million tonnes of wheat (compared to an average of 3.6 million tonnes in the previous decade), relatively modest wheat releases (5.5 million tonnes) and net exports. The decline in availability put upward pressure on domestic wheat prices, which started to increase in 2003 and approached import parity prices in 2004/05.

At the end of the period, in 2006/07, international wheat prices started to rise while domestic prices fell in response to expectations of a bountiful 2007 harvest (Dorosh, 2008). As a result, the export parity price caught up with domestic prices again. In April 2007 the government lifted the export ban on wheat (flour) that had been in place since 2003 and permitted 500 thousand tonnes of private sector wheat exports (Dorosh, 2008; Persaud, 2010).

The 2007/08 food price spike

In 2007/08 international wheat prices surged, causing the import and export parity price to roughly double in early 2008 compared to pre-shock prices. The government, aiming to prevent domestic prices from rising as well, reinstated the export ban for wheat and wheat flour (except for Afghanistan) in May 2007 and started importing large quantities of wheat. In early 2008, the government extended the export ban to Afghanistan (Persaud 2010).

Despite these interventions, domestic wheat prices started to rise as well in late 2007, increasing from 9.52 Rs/kg in July 2007 to 13.34 Rs/kg in July 2008, an increase of about 71 %. Yet, Figure 3.4 shows that this domestic price increase was not nearly as great as the surge in international prices in 2007/08. According to a World Bank (2010) report, the limited domestic price increase is explained by the fact that Pakistan largely relied on its domestic wheat supply to meet demand in the 2000s and the wheat price stabilization policy disconnected the domestic wheat market from the international market, allowing only a partial transmission of international prices to domestic prices.

The domestic price rise was not caused by a shortfall in production, as the 2007 harvest reached a new record of over 23 million tonnes. The World Bank (2010) argued that the price increase was caused by a decrease in availability due to large-scale informal exports to Afghanistan. The gap between state controlled low prices in Pakistan and high international wheat prices in 2007/08 created strong incentives for the private sector to export wheat to Afghanistan, where the 2008 wheat harvest was exceptionally low. In 2007, private wheat (flour) exports occurred legally. After the export ban was extended to Afghanistan in early 2008, wheat flour exports apparently continued to flow to Afghanistan informally. It is estimated that in total about 1.5 to 2 million tonnes of wheat flour were illegally exported to Afghanistan during the food price shock (USDA, 2014b; World Bank, 2010).

Dorosh (2008) suggested that an overestimation of the 2007 harvest may have contributed to the domestic price rise. Another possible explanation is widespread hoarding behaviour due to expectations that domestic prices would eventually increase (Tayyab, 2013; World Bank, 2010). One possibility is that private agents expected the government to increase the support price in order to stimulate production in the face of the international food price spike.

In fact, the support price did increase considerably in this period: from 9.20 Rs/kg in July 2007 to 14.88 Rs/kg in July 2009, a very significant increase of 62 %. It seems likely that such a strong increase of the support price has contributed to rising domestic wheat prices.

Table 3.1 presents estimations of net imports and net availability for the period 2007/08-2008/09 based on USDA (2014b) statistics of 2.2 million tonnes of wheat and flour exports (in wheat equivalents) in 2007/08 and 2.1 million tonnes in 2008/09. These estimates imply that net availability per capita was at 124 kg/capita in 2006/07, at 124 kg/capita in 2007/08 and at 112 g/capita in 2008/09. Hence, in 2007/08 net availability remained at the same level as the year before – even under the assumption that significant volumes of wheat flour exited the country to Afghanistan. The high net availability in 2007/08 can be explained in part by the record harvest in 2007, and in part by government interventions in the form of large-scale wheat imports (1.8 million tonnes), large wheat releases and modest procurement (6.3 million tonnes released versus 4.4 million tonnes procured). In 2008/09, the government imported even larger quantities of wheat (3.1 million tons) in response to the disappointing 2008 harvest, but these were insufficient to prevent net availability from falling. The reduced net availability further fuelled the rise of domestic wheat prices, which continued to increase throughout 2008 and 2009.

The decline of international food prices

The high support price in late 2008 stimulated wheat production in Pakistan, resulting in a bountiful 2009 harvest of 24 million tons. Despite this new record harvest domestic prices further increased, peaking at 15.9 Rs/kg in December 2009. The price peak was likely caused by a combination of massive government wheat procurement (9.2 million tonnes), low public imports and relatively modest wheat releases (6 million tonnes), which caused net availability per capita to decrease compared to 2008/09 (to 106 kg/capita).

This contrasted with the decline of international wheat prices, which started to fall in late 2008 and reached very low levels in mid-2010. Rising domestic prices in combination with falling international wheat prices caused domestic prices to be at par with import parity in this year. As a result, informal wheat (flour) exports were limited. In early 2010, Pakistan wheat prices started to fall as well.

After 2010/11

In July 2010 Pakistan was hit by severe floods, but as the 2010 wheat crop was already harvested and stored the floods had little impact on the 2010 wheat harvest (USDA, 2011). In fact, the 2010 harvest was slightly better than expected: according to the USDA (2010), the wheat harvest was only 3 % lower than the record harvest of the previous year. The next year, Pakistan was again hit by floods, but the 2011 wheat harvest was likewise unaffected by the floods and reached a new record level of 25 million tons.

Net availability per capita in 2010/11 increased to 111 kg/capita and again to 120 kg/capita in 2011/12 following the record 2011 harvest, thereby ending the downward trend in availability since 2007/08. As a result of the increase in net availability, domestic prices started to fall and strongly so, having declined by 27 % in July 2012 compared to the peak in December 2009. In 2012/13 domestic supply again decreased due to a bad 2012 harvest, but the government partly countered the production shortfall by releasing large volumes of wheat compared to procurement (6.8 versus 5.8 million tons) and thereby managed to limit the decline of net availability per capita (to 117 Rs/kg). Nevertheless, domestic prices started to increase again in 2012/13.

International wheat prices rose again in mid-2010, fell in late 2011 and rose again in mid-2012. Although the price spikes did not attain the same height as the 2007/08 price spike, the average price level over the period 2010/11-2012/13 was considerably higher than the average pre-shock international price level in both nominal and real terms. As domestic wheat prices did not follow the second rise in international wheat prices in mid-2010 and mid-2012, the export parity price rose to the level of domestic prices. Hence, Pakistan wheat became competitive on the world market in these years.

The wheat (flour) export ban was lifted in December 2010 and exports reached a record level in 2010/11 at 1.7 million tonnes of wheat and 1.2 million tonnes of wheat flour. In the next two years, wheat and particularly flour exports showed a downward trend but remained large. As a result, Pakistan became a net wheat (flour) exporter in these years.

3.3. Measuring the impact of government policies: the nominal rate of assistance

To measure the impact of government policies we use the nominal rate of assistance (NRA) methodology, which has been well established by Anderson (2009) and Anderson et al. (2008a, 2008b) and its application to Pakistan by Dorosh and Salam (2007; 2009). The NRA measures the extent of distortions to farmer and consumer price incentives generated by direct and indirect government intervention at the border and in domestic markets. It can serve as an indicator of distortions to prices of individual commodities such as wheat.

The NRA is mostly used for calculating welfare effects of government interventions for farmers and consumers. This is the case for most of the studies in the World Bank project coordinated by Kym Anderson, including the study by Dorosh and Salam (2007; 2009) on Pakistan. In our study, we extend the methodology and its application to measure the welfare effects for different agents in the value chain. More specifically, we calculate the NRA at the following stages of the value chain of wheat (flour): at the level of (1) wheat farmers (2) wheat traders (3) wheat flour millers and (4) wheat flour consumers.

The NRA is calculated on a monthly basis and on a yearly basis. Monthly NRAs are calculated using monthly domestic and border prices; annual NRAs are calculated using annual averages of these prices across wheat crop marketing years (May – April the following year).

3.3.1. Basic principle (methodology) for NRAs in the value chain

The NRA to agent *i* in a vertical chain is calculated according to the following general formula:

$$NRA^i = \frac{(p_o^i - p_o^{i*}) * Q_o^i + \Sigma_j\left(p_j^{i*} - p_j^i\right) * Q_j^i}{p_o^{i*} * Q_o^i} \quad (1)$$

where p_o^i is the actual domestic price of output *o*, p_o^{i*} is the 'undistorted' domestic output price, i.e. the price without government intervention, Q_o^i is the quantity of output sold, p_j^i is the actual domestic price of input *j*, p_j^{i*} is the 'undistorted' domestic price of input *j* and Q_j^i is the quantity of input *j* used to produce output *o*.

Government policies can affect the welfare of agent *i* in the value chain by changing input prices and/or output prices. The NRA to agent *i* can therefore be rewritten as:

$$NRA^i = \frac{p_o^i - p_o^{i*}}{p_o^{i*}} + \frac{\Sigma_j\left(p_j^{i*} - p_j^i\right) * Q_j^i / Q_o^i}{p_o^{i*}} \quad (2)$$

$$= NRA_O^i + NRA_I^i$$

where Q_{Ij}^i / Q_o^i represents the conversion rate from input *j* to output *o*. The NRA to output, NRA_o^i, measures the extent of distortions to output prices expressed as a percentage of the undistorted domestic output price. The NRA to input, NRA_I^i, measures the total extent of distortions to input prices for all inputs *j* used to produce output *o*, expressed as a percentage of the undistorted output price. The total NRA^i to agent *i* then equals the sum of both.

3.3.2. NRA to the wheat sector (wheat farmers and wheat traders)

a) Indicators and assumptions

The NRA to the wheat sector captures the cumulative rate of assistance to farmers (NRA^f) and wheat traders (NRA^t), or the nominal rate of assistance to wheat NRA^w.

$$NRA^w = NRA^f + NRA^t \quad (3)$$

where

$$NRA^f = NRA_O^f + NRA_I^f \quad (4)$$

$$NRA^t = NRA_O^t + NRA_I^t \quad (5)$$

$$NRA_O^f = \frac{p_o^f - p_o^{f*}}{p_o^{f*}} \quad (6)$$

$$NRA_I^f = \frac{\Sigma_j\left(p_j^{f*} - p_j^f\right) * Q_j^f / Q_o^f}{p_o^{f*}} \quad (7)$$

$$NRA_O^t = \frac{p_o^t - p_o^{t*}}{p_o^{t*}} \quad (8)$$

$$NRA_I^t = \frac{\Sigma_j\left(p_j^{t*} - p_j^t\right) * Q_j^t / Q_o^t}{p_o^{t*}} \quad (9)$$

This implies that

$$NRA^w = \frac{p_o^f - p_o^{f*}}{p_o^{f*}} + \frac{\Sigma_j\left(p_j^{f*} - p_j^f\right) * Q_j^f / Q_o^f}{p_o^{f*}} + \frac{p_o^t - p_o^{t*}}{p_o^{t*}} + \frac{\Sigma_j\left(p_j^{t*} - p_j^t\right) * Q_j^t / Q_o^t}{p_o^{t*}} \quad (10)$$

For wheat traders, both input and output are wheat and hence $Q_o^t = Q_j^t$. The formula to calculate wheat trader input NRA_I^t then becomes:

$$NRA_I^t = \frac{(p_I^{t*} - p_I^t)}{p_o^{t*}} \tag{11}$$

Given that the output price received by farmers equals the input price paid by wheat traders, or $p_o^f = p_I^t$ and $p_o^{f*} = p_I^{t*}$, equation (12) can be written as:

$$NRA^w = \frac{p_o^f - p_o^{f*}}{p_o^{f*}} + \frac{\sum_j \left(p_j^{f*} - p_j^f\right) * Q_j^f / Q_o^f}{p_o^{f*}} + \frac{p_o^t - p_o^{t*}}{p_o^{t*}} + \frac{p_o^{f*} - p_o^f}{p_o^{t*}} \tag{12}$$

The second term in equation (12) captures the NRA to farm input NRA_I^f. Earlier World Bank estimates (Anderson and Nelgen, 2013) assumed that the NRA to farm input for wheat was zero from 2006 to 2010 (see Table A2.1, Appendix 2). However, according to a recent IFPRI policy report (Salam, 2012: 9-10): "… the cost of domestically produced urea has been less than the imported price due to the subsidized gas supply to the fertilizer industry. Since both imported and local fertilizers are sold at the same rate, the government has to subsidize the imported urea, the import of which has recently been confined in the public sector to the Trading Corporation of Pakistan. […] Accordingly, there has been an implicit element of subsidy in the sales price and use of these fertilizers [urea and DAP] throughout the reference period." Moreover, a report by the World Bank (2010:129) similarly states that in the 2007/08 fiscal year " [f]ertilizer subsidies (mainly on di-ammonium phosphate or DAP) also became an increasingly large fiscal burden because of increased world market prices.".

The use of urea and DAP accounted for about 93 % of total fertilizer cost and 22 % of total farmer production costs per acre in the last two wheat crop years (MY2012-MY2013).[12] Hence, any (implicit) subsidy to these fertilizers was likely non-trivial also after 2005, in particular during the international food price shock. We account for this subsidy by calculating the NRA to urea and DAP fertilizer for 2000-2013 and adding it to the NRA to farmer output.[13] Although the NRA to fertilizer does not take into account assistance to other important inputs such as water, according to Dorosh and Salam (2007) it captures the major distortion to non-factor agricultural input prices in Pakistan. In addition, our calculated NRA to fertilizer approaches the World Bank estimates of the NRA to farm input reasonably well for the years in which the World Bank estimates are non-zero.[14]

The third term in equation (12) captures the NRA to wheat trader output NRA_O^t. The government does not directly subsidize or tax wheat trader output, but procurement and release quantities may affect the price received by wheat traders at the wholesale market. As mentioned earlier, the government procures on average about 40 % of marketed wheat nation-wide and may supplement procured wheat with public wheat imports. The government then sells wheat to flour millers at the release price, which is on average lower than the wholesale price of wheat (see Figure 3.6). Procurement, imports and releases may

[12] Author's calculations based on API data.

[13] Details on the calculation of the NRA to farmer input are provided in Appendix 1.

[14] For 2000-2005, the average difference is equal to 0.2 percentage points, or about 7.5 % of the World Bank average NRA to farm input for 2000-2005.

lead to net injections or net withdrawals of wheat from the domestic wheat market, thereby affecting domestic wheat prices.

To calculate the third term, we use the price of wheat at the Lahore wholesale market as an indicator for p_o^t. For the undistorted wholesale price for wheat p_o^{t*} one should use the border price measured at the Lahore wholesale market. Regarding the border price, Dorosh and Salam (2007) argue that in many years domestic prices would likely lie between import and export parity in the absence of government interventions. Hence, the conventional approach of using import (export) parity prices as border prices for wheat will understate (overstate) the nominal rate of assistance. The authors correct for this problem by using estimated autarky (no trade) prices as the border price when the autarky price is below import parity.

In this study, we follow the methodology of Dorosh and Salam (2007).[15] The main difference is that import and export parity prices for wheat were calculated using Lahore as the reference market instead of Karachi. The import parity price for wheat measured at the wholesale market in Lahore equals the C&F Karachi price plus import costs and marketing costs from Karachi to the wholesale market in Lahore. The export parity price for wheat at the wholesale market in Lahore equals the FOB Karachi price minus export costs and marketing costs from Lahore to Karachi.[16]

We use the trade status used by Dorosh and Salam (2007) and the World Bank NRA database (Anderson and Nelgen, 2013) and consider wheat to be an import-competing product for 2000/01-2009/10, except in 2007/08 (exportable). For 2010/11-2012/13, we have considered wheat to be an export-competing product. Table A2.2 in Appendix 2 specifies the border price (import parity, export parity or autarky price) used for each year. The use of import parity, export parity or autarky prices was the same for each agent in the value chain.

Similarly, for the calculation of the first term in equation (12), one should use the border price for wheat measured at the farmgate in Lahore as an indicator of the undistorted farmgate price for wheat p_o^{f*}. Import and export parity prices measured at the farmgate are equal to import and export parity prices measured at the Lahore wholesale market minus marketing costs from the farmgate to the wholesale market in Lahore.

We attempt to split up the NRA to agriculture in the NRA to farmers and the NRA to wheat traders, in order to shed light on the distribution of rents between these two agents. A critical variable is the price that traders pay to farmers – the farmgate price – which would be the correct measure for p_o^f ($= p_I^t$). However, data on farmgate prices are not available for Pakistan. We have therefore calculated an indicator for farmgate prices under two assumptions, which have implications for the distribution of rents between farmers and traders.

Assumption 1: Farmgate price equals support price

In the first approach, we assume that wheat traders pay farmers the support price set by the government. Kurosaki (1996, cited in Ahmad et al., 2005) for example examines the spatial

[15] For a full description of the methodology used, see Dorosh and Salam (2007).

[16] The calculation of border prices for wheat is described in more detail in Appendix 2.

and intertemporal price relations of grains in the Punjab province and concludes that in the case of wheat, farmgate prices are explained mostly by the support price. Hence, we assume that

$$p_o^f = p_I^t = support\ price$$

In this case, fluctuations of the wholesale price of wheat are captured entirely by wheat traders and are not passed on to farmers. Another interpretation of this assumption is that the support price is the price received by farmers when selling wheat to the government during the procurement season.

Assumption 2: Farmgate price equals wholesale price minus trader marketing costs

In the second approach, we assume that wheat traders pay farmers the wholesale price of wheat at Lahore minus marketing costs from the farmgate to the wholesale market in Lahore. Hence, we assume that

$$p_o^f = p_I^t = wholesale\ price\ Lahore - trader\ marketing\ costs$$

In this case, the trader marketing margin is assumed to be fixed and fluctuations of the wholesale price are passed on entirely to farmers.

Figure 3.1 shows that the real wholesale price (minus marketing costs) fluctuates according to the wheat season: wholesale prices generally fall in the months following the wheat harvest and increase towards the winter. In most of the 1990s, 2004-2006 and 2008, the wholesale price minus marketing costs exceeded the support price throughout the year, including in the months following the harvest. Hence, in these years farmers would be better off receiving the wholesale price minus marketing costs throughout the year, as they would be capturing the rents of higher wholesale prices. In other years, the wholesale price minus marketing costs falls below the support price during post-harvest months. Hence, in these years farmers would be better off receiving the support price in post-harvest months.

b) Results

We first discuss the impact on the wheat sector as a whole and then discuss how the impact is split between farmers and traders.[17] Table 3.2 presents the average NRA for different agents along the value chain across 2000 – 2013 and for 3 sub-periods: 2000-2004, 2005-2008 and 2009-2013. The averages of the NRA at the level of wheat farmers and wheat traders are given for both farmgate price indicators (support price and wholesale price minus trader marketing costs).

Impact on the wheat sector

Figures 3.7 and 3.8 present the monthly and annual NRA to the wheat sector (wheat farmers and wheat traders). The average NRA to the wheat sector for 2000-2013 equals - 9 %, indicating that the wheat sector as a whole is on average taxed. In fact, throughout the period the annual NRA to wheat is positive only in 2005/06 and in 2010/11 at 18 % and 11 %. In 2011/12 and 2012/13, the monthly NRA fluctuates around zero, causing the annual NRA to

[17] Data used in the calculation of the NRA to wheat farmers and wheat traders is presented in Tables A2.2 and A2.3 in Appendix 2.

be close to zero. The NRA reaches a minimum in 2007/08 at - 25 %. Hence, during the international food price shock the wheat sector as a whole is taxed most heavily. Average wheat sector taxation is highest in the sub-period 2000-2004, i.e. the period before the food price shock, at - 20 % and lowest in the sub-period 2009-2013 at - 2 %.

Impact on wheat traders

Figures 3.9 and 3.10 show the monthly and annual NRA at the level of wheat traders for the two indicators of the farmgate price. Figure 3.11 shows the annual NRA at the wheat trader level, to wheat trader input and wheat trader output using the support price indicator. The calculated policy impact on the wheat traders depends strongly on the assumption of what determines the farmgate price, and to what extent the trader's margin changes with changing wholesale prices.

In the extreme case that the traders' margin is fixed, i.e. traders pay farmers the wholesale price minus marketing costs, there is very little policy impact on the traders. In other words, the NRA to traders is approximately zero throughout the period. In this case, the difference between the domestic input and output price for wheat traders is equal to marketing costs from the farmgate to Lahore, which is equal to the difference between the border price at the farmgate and at the wholesale market. Hence, the NRAs to wheat trader input and output are approximately equal and of opposite signs and thus cancel each other out, producing an NRA equal to zero.

If traders pay farmers the support price, they will be able to capture the rents created by fluctuations of the wholesale price. In this case, the NRA to traders is positive or zero throughout the period and slightly below zero in 2011/12 and 2012/13. On average, the net subsidy to wheat traders for the period 2000-2013 is 6 %, with subsidization being highest in the sub-period 2005-2008 at 10 % and lowest in the sub-period 2009-2013 at 4 %. The overall net subsidization of wheat traders is a result of two opposing policy effects. Traders are generally taxed on output by policies reducing their sales price, but benefit from policies lowering the price they pay to farmers and the second effect is strongest. This is reflected in the calculated NRAs to input and output in Figure 3.11.

Traders are taxed on their output side as the price they receive for wheat sales would be higher in a no-distortions scenario (see Figure 3.4). Traders are subsidized on the input side as the support price they pay to farmers is lower than the hypothetical wheat price they would have to pay in a no-distortions scenario. [18] The subsidy to inputs exceeds the tax on output, as traders are capturing the rents of fluctuations of the wholesale wheat price above the support price. The result is a net subsidization of wheat traders. The larger the price wedge between the support price and the wholesale wheat price, the larger the subsidy to traders.

[18] In 2005/06 and 2010/11 the general situation is reversed: traders are taxed on input and subsidized on output. For 2005/06, this is explained by the fact that the autarky price was lower than domestic wheat prices and in fact close to export parity due to a bountiful harvest in 2005 (see Figure A2.1 in Appendix 2). For 2010/11, the explanation is the switch from import parity in 2009/10 to export parity in 2010/11 and the fact that export parity was below domestic prices until 2011 (see Figure 3.4).

From 2009/10 onwards, the NRA to wheat traders moves close to zero as the gap between domestic prices and border prices decreases. That is, traders are paying and receiving a price that is very close to the hypothetical price in a no-distortions scenario. In 2009/10, domestic prices had risen to high levels and were close to import parity. In late 2010, the export ban on wheat (flour) was lifted and as domestic prices were below export parity, large wheat (flour) exports ensued. In the following years, liberalized wheat trade likely contributed to keeping domestic prices near export parity. In 2011/12 and 2012/13, the NRA is slightly negative because the subsidy to inputs falls close to zero.

In 2007/08, at the height of the international food price shock, the government responded to rising prices by imposing an export ban and supplementing domestic production with large-scale imports at below-market rates and thereby prevented domestic prices from rising to the same extent as international prices. The result was a large gap between the export parity price and domestic prices and a considerable taxation of wheat trader output (see Figure 3.4). Even though domestic wholesale prices did not follow international prices, they did increase, and the rents were captured entirely by wheat traders as a subsidy on inputs. This subsidy exceeded the tax on output and resulted in a net subsidization of 13 %.

Figure 3.9 shows that there is a seasonal fluctuation in the monthly NRA to wheat traders: during or immediately after the wheat harvest, the NRA to wheat traders falls sharply to zero or below zero. These sharp declines are caused by the seasonal drops in the wholesale price of wheat after the harvest, which increase the tax on trader output in post-harvest months.[19]

Impact on wheat farmers

Since wheat traders and wheat farmers effectively share the effects on the wheat sector as a whole, the assumption on the farmgate price has the opposite implications for wheat farmers. With fixed trader margins (i.e. traders paying the wholesale price minus marketing costs), the fluctuations in the wheat sector NRA are equal to those of the farmers as the NRA to wheat traders is zero. If trader margins can fluctuate in response to changing prices, the impacts on the farmers will be more negative than for the sector as a whole, as the benefits of higher wholesale prices will be captured by traders instead of farmers.

Figures 3.12 and 3.13 show the monthly and annual NRA to wheat farmers for alternative indicators of the farmgate price. According to our NRA calculations, wheat farmers were generally taxed by government policies in 2000-2013, regardless of the indicator used for the farmgate price.[20] When farmers receive the wholesale price minus marketing costs and

[19] According to Dorosh and Salam (2008), a large part of total marketed wheat is sold by farmers within four months of the wheat harvest. Seasonal wheat sales by traders will depend on many factors, including private market price expectations and private storage behaviour. Yet, if a large part of trader wheat sales occurs in the post harvest period as well, the seasonal fluctuations of wholesale wheat prices may have implications for the NRA to traders. Calculating the NRA to wheat traders for post harvest months (May-August) only does not change the results qualitatively (results not reported, but available on request).

[20] In 2005/06 and 2010/11 farmers were exceptionally subsidized. The explanation is analogous to the explanation provided for trader input taxation/output subsidization in these years (cfr. supra). For instance, the large positive NRA in 2010/11 is explained by a switch of the border price from import to export parity in May 2010, and the fact that the export parity price was far below domestic wheat prices until late 2010-early 2011.

thus fully capture wholesale price fluctuations, the tax is on average 9 % for the whole period (see Table 3.2). When farmers effectively receive the support price instead, the average tax increases to 15 %. Farmer taxation is driven entirely by a tax on wheat farmer output, as the NRA to wheat farmer input (fertilizer) is positive throughout the period.

Figures 3.12 and 3.13 show that the NRA to farmers fluctuates considerably across years. The extent of taxation is largest in 2007/08, during the spike in international wheat prices, with the NRA equal to - 24 % (wholesale price indicator) or - 37 % (support price indicator).[21] The large increase in the tax on farmers during the food price shock was driven by the large increase in the gap between domestic wheat prices and the export parity price. As the government prevented domestic prices from rising by imposing a ban on wheat (flour) exports and releasing large quantities of subsidized wheat on the market, farmers were receiving a substantially lower price than what they would have received in a no-distortions scenario.

In spite of the peak in farmer taxation during the food price spike, average farmer taxation is highest in the sub-period before the food price crisis: the average NRA was - 20 % to - 25 % in 2000-2004. Average farmer taxation was smallest in the sub-period 2009-2013 at - 2 % to - 6 %.

Figure 3.12 shows that the NRA to wheat farmers shows seasonal fluctuations when famers receive the wholesale price of wheat minus marketing costs. The explanation is analogous to the explanation offered for wheat traders: as the wholesale wheat price drops in post-harvest months, the price received by farmers drops as well, increasing the tax on farmer output.[22]

The shift from large farmer taxation in the 2000s to NRAs close to zero in 2012-2013 can be explained by the same factors as the shift in the NRA to traders. As domestic support and wholesale prices fluctuated around the export parity price, the NRA was driven close to zero. The convergence of domestic and export parity prices of wheat can be explained by the fact that (1) the export parity price had increased to a higher average level following the international price rises in mid-2010 and mid-2012, approaching high domestic wheat flour prices (2) the government allowed private sector wheat (flour) exports in late 2010 and (2) Pakistan became a net wheat exporter from 2010/11 onwards. The resulting market forces likely pushed domestic prices towards export parity in 2011-2013.

[21] In general, the tax on farmers is larger for the support price indicator, as the support price is on average lower than the wholesale price minus marketing costs. However, in 2011/2012 and 2012/13 the NRAs are nearly equal in size for both indicators. Figure 3.4 shows that the support price was increased to such an extent since 2007/08 that the average gap between the two farmgate price indicators has become small in recent years, reducing the difference between the corresponding NRAs.

[22] Calculating the NRA to wheat farmers for post harvest months (May-August) only does not change the results qualitatively, and in most years the results are quantitatively similar as well (results not reported, but available on request).

3.3.4. NRA at the level of flour millers

a) Indicators and assumptions

For the calculation of the NRA to flour millers, we assume that wheat grain is the only input of flour millers.[23] The NRA formula for flour millers can then be written as:

$$NRA^m = \frac{p_o^m - p_o^{m*}}{p_o^{m*}} + \frac{(p_I^{m*} - p_I^m) * Q_I^m / Q_o^m}{p_o^{m*}} = NRA_O^m + NRA_I^m \quad (13)$$

where p_o^m is the price of wheat flour received by flour millers, p_o^{m*} is the undistorted price of wheat flour received by flour millers, p_I^m is the price of wheat paid to traders and p_I^{m*} is the undistorted price of wheat paid to traders. Q_o^m is the quantity of wheat flour sold and Q_I^m the quantity of wheat purchased by flour millers. Hence, Q_I^m/Q_o^m is the conversion rate of wheat to wheat flour.

NRA to flour miller input (NRA_I^m)

The government directly subsidizes flour miller input by selling procured and imported wheat to flour mills at the release price, which is on average lower than the wholesale price of wheat. We use the border price for wheat at the wholesale market in Lahore as an indicator for p_I^{m*} and a weighted average of the release price and the market wholesale price of wheat in Lahore as an indicator for p_I^m. The weights are equal to the annual share of government releases and market wheat in total wheat available on the domestic market (wheat production marketed plus net government injections). We set the extraction rate of wheat flour milling (Q_I^m/Q_o^m) to 82 percent.[24]

The indicator for p_o^{m*} is the border price for wheat flour. Appendix 3 describes the methodology used to calculate autarky prices for wheat flour and import and export parity prices for wheat flour, using Lahore as the reference market. For the import parity price, two sets of prices are calculated. One assumes that Pakistan would import wheat flour from the EU or Black Sea region, the second assumes that Pakistan would import wheat flour from Kazakhstan.

NRA to miller output (NRA_O^m)

The government of Pakistan directly intervenes in the wholesale market for wheat flour by setting ceiling prices for sales of flour milled from government wheat. However, flour produced from government wheat cannot be distinguished from flour produced from open market wheat (see section 2). As a result these ceiling prices are not enforced (Dorosh and

[23] Wheat purchases account for approximately 90 % of production costs of flour milling according to Prikhodko and Rybchynsky (2009) and author's calculations based on data from International Finance Corporation (2011). We therefore abstract from possible subsidies to other inputs such as electricity, fuel or water.

[24] This is the extraction rate for Atta flour (82 %). Throughout the analysis we use domestic prices for (superior quality) Atta flour, which is the main type of flour consumed in Pakistan (USDA 2012b).

Salam, 2008). We therefore assume that all wheat flour is sold at the market price and use the wholesale price of wheat flour in Lahore as an indicator for p_o^m.[25]

b) Results

Figures 3.14 and 3.15 show the monthly and annual NRA at the flour miller level for the period 2000-2013 using alternative sets of import parity prices (for imports from the EU and for imports from Kazakhstan).[26] Figure 3.16 shows the NRA to flour miller input and flour miller output for 2000-2013 (using EU import parities). Table 3.2 shows the average NRA to flour millers for the whole period and three sub-periods for EU import parity prices.

The EU import parity price is significantly lower than the Kazakhstan import parity price: over the period 2000-2013 the average real EU and Kazakhstan import prices are 27.56 Rs/kg and 32.87 Rs/kg. This difference leads to a difference in the size of the NRA of roughly 10 % to 20 % for years in which the import parity price is used.

Regardless of the import parity price used, flour millers are generally taxed by existing government policies in 2000-2013, but the effect is relatively small. The average NRA over the period 2000-2013 is - 4 % for EU import parity prices. Taxation was highest in the sub-period 2000-2004, with an NRA of - 9 %. In the sub-period 2005-2008 taxation was smallest: the average NRA was slightly positive at 1 %.

The NRA fluctuates significantly across the period, reaching a maximum of 8 % in 2005/06 and falling to a minimum in 2000/01 and 2001/02 at - 18 and - 19 % for EU import parities. In 2003/04 - 2005/06 and 2008/09 the NRA to flour millers was positive, indicating that flour millers were (modestly) subsidized. After 2010, flour millers were again taxed in the order of - 6 % to - 15 %. The only break in the period of subsidization from 2003/04 to 2008/09 is at the height of the food price crisis in 2007/08, when the NRA drops below zero to - 6 %.

Figure 3.16 shows that the NRA to flour miller input is positive throughout the period regardless of the import parity price used (except for the years 2005/06 and 2010/11). The subsidy on wheat input is driven by two prices: the wholesale price of wheat at Lahore and the release price. As the wholesale price of wheat tends to be below wheat border prices, flour millers are implicitly subsidized on wheat input purchased at the market. This subsidy is the counterpart of the taxation of wheat trader output discussed above. The implicit subsidy on open market wheat inputs is supplemented by an explicit subsidy of government sales of wheat to flour millers at below-market rates (the release price). In some years, this 'double' subsidy to wheat input was sufficiently large so as to compensate the tax on output, resulting in a net subsidization of flour millers.

At the height of the food price crisis in 2007/08, the subsidy to wheat input peaked at 23 %, as the gap between domestic wheat prices and export parity increased sharply. Nevertheless, flour millers were taxed in this year, as the increase of the wheat flour export parity price over domestic flour prices was even greater (see Figures 3.4 and 3.6).

[25]Monthly data for the wholesale price of wheat flour was only available from FY2009 onwards. We have therefore used annual wholesale prices of wheat flour for the period FY2001-FY2008.

[26] Data used for the calculation of the NRA to flour millers is presented in Table A2.4 in Appendix 2.

Figure 3.16 shows that flour millers are taxed on output in all years except 2005/06.[27] For the entire period 2000-2013, the average tax on flour miller output is - 14 % for EU import parities. This taxation is explained by the fact that domestic wholesale prices of wheat flour were substantially lower than wheat flour border prices, i.e. the undistorted wheat flour market price (see Figure 3.6). Government policies lowering domestic wheat prices also result in lower domestic wheat flour prices, but the gap between domestic flour prices and wheat flour border prices was generally larger than the gap between domestic wheat prices and wheat border prices, resulting in a net taxation of flour millers.

In recent years, the subsidy to wheat input has declined due to the convergence of domestic wheat prices and the export parity price for wheat. As flour millers continued to be taxed on flour output, the net result was taxation. Nevertheless, the extent of taxation is lower compared to the early 2000s, as domestic flour prices have increased relative to border prices. In the last two years of the period, net taxation remains smaller than 10 %.

3.3.5. NRA at the level of flour consumers

a) Indicators and assumptions

We calculate the NRA to wheat flour consumers as follows[28]:

$$NRA^c = \frac{(p_I^{c*} - p_I^c)}{p_I^{c*}} \tag{14}$$

where p_I is the domestic price of wheat flour paid by consumers and p_I^* is the undistorted consumer wheat flour price. We use the border price of wheat flour at the retail market in Lahore as an indicator for p_I^*. This border price should be calculated by adding marketing costs of retailers to the border price of flour measured at the wholesale market. As we did not have information on retailer marketing costs, we have estimated an upper and lower boundary of the actual border price at the retail market. The upper boundary border price is calculated under the assumption that retailer marketing costs are equal to the price margin between the wholesale price and retail price of wheat flour, i.e. that retailer marketing margins are zero. The lower boundary border price is calculated under the assumption that retailer marketing costs are zero, i.e. that retailer marketing margins are equal to the price margin. The actual border price measured at the retail market will lie in between these boundaries, and the actual NRA to flour consumers will probably be in between the resulting upper boundary and lower boundary NRA.

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[27] The exception in 2005/06 is due to the fact that the autarky price dropped due to a good 2006 harvest and was lower than the domestic wheat flour price (see Figure A2.2 in Appendix 2).

[28] The consumer tax equivalent (CTE) of Anderson et al. (2008a) captures the effect of distortions on price incentives of final consumers expressed as a percentage of the undistorted consumer price. The CTE can be calculated as follows:

$$CTE = \frac{(p_I - p_I^*) * Q_I}{p_I^* * Q_I}$$

where input I represents the commodity purchased for consumption, p_I is the actual domestic consumer price, p_I^* is the undistorted domestic consumer price and Q_I equals the quantity consumed. The NRA for the final consumer relates as follows to the consumer tax equivalent (CTE) of Anderson et al. (2008a):

$$CTE = -NRA^c = -NRA_I^c$$

for *i* = *c* for the final consumer for whom $Q_o^c = 0$ and thus $NRA_O = 0$.

The government directly intervenes in the retail market for wheat flour through the Utility Stores Corporation, which sells wheat flour at subsidized prices to consumers. However, as discussed in section 2 the effectiveness of these utility stores is questioned. Moreover, series of data on subsidized prices or the share of wheat flour sold through these Utility Stores were not available. We therefore use the open market retail price of wheat flour at Lahore as an indicator for the domestic price p_l. However, our disregarding of the consumer subsidy provided by the Utility Stores will lead us to overestimate consumer taxation or underestimate consumer subsidization. A quick, back-of-the-envelope calculation suggests that the additional NRA to consumers from the Utility Store sales in recent years may be around 3 to 8 percent.

b) Results

Figures 3.17 and 3.18 present the monthly and annual NRA at the level of the flour consumer for the period 2000-2013 for both the upper bound and lower bound of retail border prices.[29] For simplicity, Figure 3.17 only shows the NRA to flour consumers for EU import parity prices. Table 3.2 shows the average NRA to flour consumers across the period 2000-2013 and for three sub-periods, again for both the upper and lower bound of retail border prices.

Consumers generally benefitted from existing policies. The average NRA at the level of flour consumers over 2000-2013 is in the order of 5 % to 13 %, depending on the assumptions about border prices. Subsidization was highest in the sub-period 2000-2004 regardless of the type of border price used, with an average NRA of 12 % for lower bound border prices and 21 % for upper bound border prices. In the sub-periods 2005-2008 and 2009-2013, average consumer subsidization was lowest regardless of the border price used, with an average NRA of 1-2 % for lower bound border prices and 9 % for upper bound border prices.

The subsidization of flour consumers is explained by the fact that retail flour prices were generally below border prices. At the height of the international food price spike in 2007/08, consumer subsidization even increased significantly to 22 % - 27 %, more than doubling in size compared to the year before. In this year, domestic retail flour prices were kept low by large-scale government wheat imports that were released at below-market rates to flour mills. As a result, the wheat flour export parity price rose substantially above domestic flour prices.

Figure 3.17 shows that the monthly NRA to flour consumers has fluctuated considerably since 2007, reaching both high peaks and deep lows. These sharp monthly fluctuations are mainly caused by substantial fluctuations of the export parity price, as domestic retail prices remained relatively stable (see Figure 3.6). Since the average level of the domestic consumer price was close to the average level of the export parity price in these years, the annual NRAs to flour consumers remained modest.

As mentioned before, the subsidy to flour consumers through the Utility Stores is not captured by the NRAs, but it is unlikely that this subsidy will change the main conclusions here.

[29] Data used for the calculation of the NRA to flour consumers is presented in Table A2.5 in Appendix 2.

3.3.6. Key findings

Table 3.2 summarizes the NRAs for different periods and different agents along the value chain and Figure 3.19 shows the NRAs along the value chain and major wheat (flour) policy changes for the years 2000-2013. Tables A2.2 to A2.5 in Appendix 2 show the NRAs for various agents per year across the period.

Wheat farmers

Regardless of the indicator for farmgate prices, we find that farmers are taxed by government policies in nearly all periods. The magnitude of taxation depends on assumptions about the farmgate price. Assuming that the farmgate price equals the support price of wheat, average farmer taxation in 2000-2013 is 15 %. Assuming that the farmgate price equals the wholesale price of wheat minus trader marketing costs, farmer taxation is on average 9 %. The average magnitude of taxation is higher for the support price indicator compared to the wholesale price indicator (except in the last two years), and the difference is most pronounced when the gap between support prices and wholesale prices is largest.

During the food price spike in 2007/08, the NRA to wheat farmers fell strongly, reaching a minimum in the order of - 24 % to - 37 %. Farmers were not able to profit from rising international wheat prices because domestic wheat prices were kept low by the export ban and large-scale government wheat releases at subsidized prices. However, domestic prices did start to rise in late 2008 and fluctuated around the export parity price after 2010. As a result, in recent years farmer taxation was substantially reduced and the NRA was close to zero in the last two years.

Wheat traders

If we assume that the farmgate price is equal to the wholesale price of wheat, the NRA to wheat traders is zero in all periods, as the positive NRA to wheat trader input cancels out the negative NRA to wheat trader output.

If we assume that the farmgate price is equal to the support price, wheat traders are generally subsidized by existing government policies. The average subsidy for 2000-2013 was 6 % and for most sub-periods equal to or below 5 %. The exception is the period of the international price spike. The assumption that farmers get the support price implies that traders could capture much of the gains of the price spike. The average subsidization of wheat traders in the period 2005-2008 was 10 %, and even 13 % during the 2007-2008 food price spike. This result indicates that the combination of wheat price spikes and the support price policy are benefitting wheat traders, and not farmers, when traders pay farmers the support price. The average subsidization of wheat traders fell back to 4 % in the period 2009-2013. This result corresponds to the decrease of wheat farmers taxation and is caused by the fact that the support price and wholesale price converged and were both at par with export parity since late 2010.

Flour millers

Regardless of the type of border price used, we find that flour millers are generally taxed by existing wheat-flour policies, but the effect is relatively small. Average taxation for the entire 2000-2013 period is 4 %. However, the NRA to flour millers varies considerably

across different sub-periods. In the period 2000-2004, average taxation is highest at - 9 %. In 2005-2008 the average NRA to flour millers increased and was slightly positive at 1 %, but millers are again taxed somewhat on average in recent years (- 4 %).

At the height of the food price spike in 2007/08, the tax on flour increased sharply as the export parity exceeded domestic wholesale flour prices by far. Even though flour millers were subsidized on wheat purchased at the market (with domestic prices below export parity) and on wheat purchased from the government at below-market rates, the subsidy was not sufficiently large to compensate the large tax on output. As a result, the tax on flour millers was 6 % during the 2007/08 price spike, and fell rapidly afterwards.

Flour consumers

The NRA to flour consumers is calculated using two alternative sets of border prices, based on two extreme scenario's. The first scenario assumes that marketing costs of wheat flour retailers are equal to the price margin between wholesale and retail flour prices (i.e. their marketing margin is zero). The resulting border prices are the upper bound on actual border prices measured at the retail market. The second scenario assumes that retailer marketing costs are zero (i.e. the retailer marketing margin is equal to the price margin) and the resulting border prices form the lower bound on actual border prices measured at the retail market. The actual NRA to flour consumers will probably be in between the NRAs calculated using the upper bound and lower bound border prices.[30]

We find that flour consumers were subsidized by government policies throughout 2000-2013 in the order of 5 to 13 % depending on the assumptions about border prices. Consumer subsidization was particularly high in the early 2000s, as domestic retail flour prices were substantially lower than border prices. In 2000-2004, the average subsidy was between 12 % and 21 %. Consumer subsidization peaked at the height of the first food price spike in 2007/08, as domestic consumer prices were kept low by the export ban on wheat (flour) and large-scale public wheat imports and releases. In recent years, the NRA to flour consumers fluctuates considerably due to large fluctuations of the export parity price of wheat flour. On average consumers continued to be subsidized in 2009-2013, but the subsidy remained below 10 %.

[30] Our estimates do not include the subsidy to flour consumers through the sales of wheat flour at below-market rates in Utility Stores, which implies that we are underestimating flour consumer subsidization, possibly by 3 % to 8 % in recent years (according to a quick, back-of-the-envelope calculation.

4. Conclusions and policy recommendations

This report analyses the degree to which Pakistan's Wheat Price Stabilization Program and whether it is effective and efficient in mitigating the impact of wheat (flour) price instability on poverty. The second chapter focuses on the efficiency aspect of the policy by analysing the public costs of the current policy structure. Chapter three focuses on the welfare implications of the current policy structure on various interest groups along the value chain of wheat (flour): wheat farmers, wheat traders, flour millers and flour consumers. To this purpose, the chapter analyses the distribution of rents/distortions of the wheat price stabilization policy for these groups (with an adjusted NRA methodology) for the years 2000 – 2013, a period characterized by major price volatility in global wheat and flour markets and by regular adjustments of domestic policies.

Chapter 2 finds that program expenditure for Punjab was low for fiscal years 2002 – 2008. Program expenditure increased considerably in response to the global food price crisis, but has since fallen again. High carry-over stocks and high associated interest costs have been the major sources of the increased program costs for Punjab since FY2009.

The analysis further shows that, while aggregate public expenditure on wheat price stabilization is low as a proportion of total public expenditure, it is high relative to the budget allocations for federal and provincial expenditure on agriculture and relative to expenditure on agriculture research. In addition, both the IMF and the State Bank of Pakistan have expressed concern that the mounting costs of the Wheat Stabilization Program, and the reliance on commercial bank credit to finance these costs, is crowding out private sector credit and adding to "quasi-fiscal pressures".

Hence, in the context of the efficiency of the wheat price stabilization policy, the findings of Chapter 2 highlight the need to rationalize expenditure on what is ultimately an untargeted subsidy program, with a growing public cost and a growing impact on commercial bank lending. As these growing public costs seem unsustainable for the government of Pakistan, policy reforms are needed to bring down public costs of the program and establish a more efficient policy structure.

The welfare analysis in Chapter 3 indicates that the wheat price stabilization policy in Pakistan has generally benefitted consumers and wheat traders at the expense of farmers (and to a lesser extent flour millers) in 2000-2013.

Flour consumers were subsidized as domestic retail prices of wheat flour were kept below the hypothetical undistorted market price. Farmers were taxed as the price they received for wheat sales was lower than the undistorted market price, both when traders pay farmers the wheat support price and when they pay farmers the wholesale wheat price minus trader marketing costs. Wheat traders generally benefitted from the policy whereas flour millers were on average taxed, although the tax is relatively small in most years. Both traders and millers were subsidized on the "input side" and taxed on the "output side". For wheat traders the subsidy to wheat purchases was larger than the tax on wheat sales, whereas for flour millers the tax on flour sales on average exceeded the subsidy to wheat input. Nevertheless, the net effect on flour millers varies significantly across periods and in several years millers were (modestly) subsidized.

During the 2007/08 food price shock, the wheat (flour) export ban in combination with large-scale public imports and releases of wheat at below-market rates prevented domestic wheat (flour) prices from rising to the same extent as international prices. The limited rise of domestic prices resulted in a particularly heavy taxation of farmers, who were not able to profit from the spike in international wheat prices. This is reflected in the NRA to wheat farmers, which reaches a minimum of - 24 % to - 37 % in 2007/08, depending on assumptions about the farmgate price. On the consumer side, domestic consumer prices were kept far below international flour prices. This is reflected in a large and positive consumer NRA in 2007/08 of 22 % to 27 %, depending on assumptions about border prices.

Trade restrictions and large-scale public imports – the main policy tools used during the food price spike – thus protected flour consumers from the negative consequences of the food price shock, but at a substantive cost to farmers. Wheat traders similarly enjoyed increased subsidies during the food price shock at the expense of a higher taxation of wheat farmers (if farmers receive the support price).

From late 2010 onwards, the NRA declined in absolute size for all groups. Farmer taxation decreased considerably: the NRA to farmers moved from large negative numbers to NRAs close to zero. The subsidy to wheat traders similarly fell close to zero, and flour miller taxation declined as well, falling below 10 %. The subsidy to consumers remained around 10% in these years. although the monthly NRAs exhibit large fluctuations.

The overall decline of distortions is explained by a convergence of domestic and international prices, which in turn is likely explained by the removal of the wheat (flour) export ban and the subsequent jump in public and private wheat (flour) exports.

Note that one should interpret these results with caution. As usual with this type of calculations the estimated effects depend on a number of assumptions, in particular regarding undistorted wheat (flour) prices, and should be interpreted with care.

In the context of the welfare impact of the policy, the findings of Chapter 3 suggest that the policy succeeded relatively well in ensuring affordable prices of wheat flour for consumers, one of its two main objectives. However, the protection of consumers came mostly at the expense of farmers, who are significantly taxed by existing policies in most years. Hence, the policy does not perform well in attaining its second objective of supporting farmer incomes, as these would presumably have been higher in the absence of these policy interventions. In addition, the achievement of domestic price stability and affordable prices has entailed substantive budget costs, as indicated by the findings in Chapter 2.

The current policy structure entails efficiency losses[31]. One efficiency loss that comes out of the NRA analysis is the subsidy to wheat traders: in the scenario where farmers

[31] See also Dorosh and Salam (2008); International Finance Corporation (2011); Lohano, Smith, and Stockbridge (1998); Prikhodko and Zrilyi (2013)

receive the support price from wheat traders at the farmgate, part of the policy rents are captured by wheat traders.

The implications of the findings summarized above point towards several recommendations for policy reforms that could improve the efficiency of the wheat price stabilization policy and the wheat market at lower costs. These proposed reforms are in line with recommendations offered by other authors (e.g. Dorosh and Salam, 2008; Dorosh, mimeo).

During the 2007/08 food price spike, the export ban and large-scale public imports succeeded in keeping domestic prices in check but created significant distortions. The subsequent liberalization of wheat (flour) trade and export promotion since late 2010 created a floor price equal to the export parity price of wheat and a ceiling price equal to the import parity price of wheat in Pakistan. The resulting convergence of domestic prices to export parity prices caused farmer taxation and wheat trader subsidization to decline, while consumers continued to receive a modest subsidy. Hence, the removal of trade restrictions in late 2010 reduced distortions created during the food price shock at the benefit of farmers without endangering domestic price stability.

This finding leads to the first recommendation for policy reform: price stability should be promoted mainly through the use of international trade, accompanied by an explicit commitment of the government to promote private wheat (flour) trade. In years of high world prices – like the 2007/08 price spike – the government could temporarily resort to export restrictions and wheat transfers sourced from public imports or a limited national security stock to prevent domestic prices from rising excessively.

The use of international trade to promote price stability may be complemented by targeted wheat transfers to food insecure and vulnerable households from a limited national security stock. This strategy may be warranted in years of high international prices and insufficient domestic production to prevent domestic prices from rising too high, or when emergency wheat distribution is needed, e.g. in the wake of natural disasters.

A second important area of reform is the current system of domestic wheat procurement and releases. The procurement system is not benefitting farmers compared to a no-intervention scenario, and public wheat transfers, if necessary, could be sourced from international trade or limited national emergency stocks. In addition, the losses brought about by poor storing of massive quantities of procured wheat and high carry-over stocks are one of the major causes of the elevated budget costs of the program. It is therefore advisable to gradually reduce domestic wheat procurement. According to Dorosh (mimeo), procurement could be at least reduced to a pre-announced target quantity of 1-2 million tons per year (for stock rotation), procured either at domestic market prices or a pre-announced support price consistent with this target quantity.

One possible objection regarding this proposed reform concerns the redistribution purposes of government procurement and releases (e.g. from wheat surplus to deficit regions). However, redistribution could be more efficiently achieved by allowing the private market to move wheat freely, while at the same time expanding and improving targeted subsidy programs and safety nets (e.g. conditional cash transfers and

employment schemes) to support food insecure and vulnerable households. As the current procurement-release policy amounts to an untargeted subsidy program with unsustainable public costs, and the effectiveness of subsidized wheat sales through the Utility Stores Corporation system has been questioned, this strategy could present a more effective and efficient way of improving access to affordable wheat (flour) for poor and food insecure households.

An abandonment of the procurement policy does not entail an abandonment of farmer support. Farmer incomes could be more effectively and efficiently supported by for instance investment in rural infrastructure, improved storage capacities or agricultural research and extension. The reduction or elimination of the current procurement policy could free up valuable resources for increased investments in these areas.

Figures and Tables

Table 2.1: Public Expenditure on Wheat Price Stabilization

	Domestic Procurement[1] (tons)	Domestic Costs[1] (million Rupees)	Imported Wheat[1] (million Rupees)	Total Cost[1] (million Rupees)	Cost as % Current Budget Expenditure[2]	Cost as % All Subsidies and Transfers[3]
FY2000	8,582,000	8,068	923	8,991	1.44%	42.4%
FY2001	4,081,000	4,106	0	4,016	0.62%	2.0%
FY2002	4,045,000	2,839	140	2,979	0.43%	1.2%
FY2003	3,514,000	6,773	1,165	7,938	0.99%	2.3%
FY2004	3,456,000	7,431	0	7,431	0.96%	3.6%
FY2005	3,939,000	0	0	0	0.00%	0.0%
FY2006	4.514,000	522	0	522	0.05%	0.2%
FY2007	4.422,000	2,251	0	2,251	0.16%	0.5%
FY2008	3,917,000	6,320	48,180	54,500	2.93%	10.4%
FY2009	9,231,000	0	50,340	50,340	2.41%	11.0%
FY2010	6,715,000	20,040	0	22,040	0.89%	3.3%
FY2011	6,220,000	19,370	0	19,370	0.64%	2.4%
FY2012	7,000,000	19,530	0	19,530	0.55%	2.1%

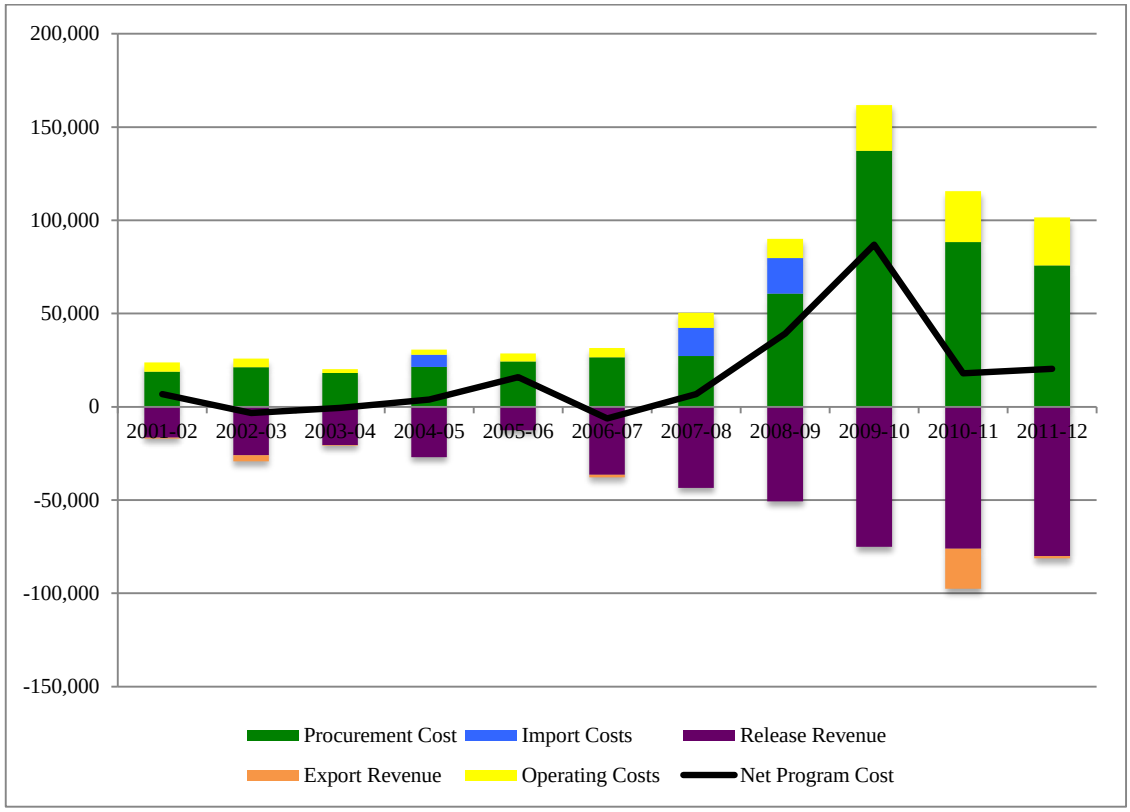
Sources: Agriculture Policy Institute of Pakistan1; IMF Country Reports2; World Bank Development Indicators[3]

Table 2.2: Public Expenditure on Agriculture FY2012 (million Rupees)

	Non-Development	**Development**	**Total**
Federal Government[a]	12,108	33,377	45,485
Provincial Governments[b]	50,898	na	50,898
Total	63,006	33,377	96,383
Wheat Stabilization	19,530	na	19,530
As percent of total	31%	na	20.3%

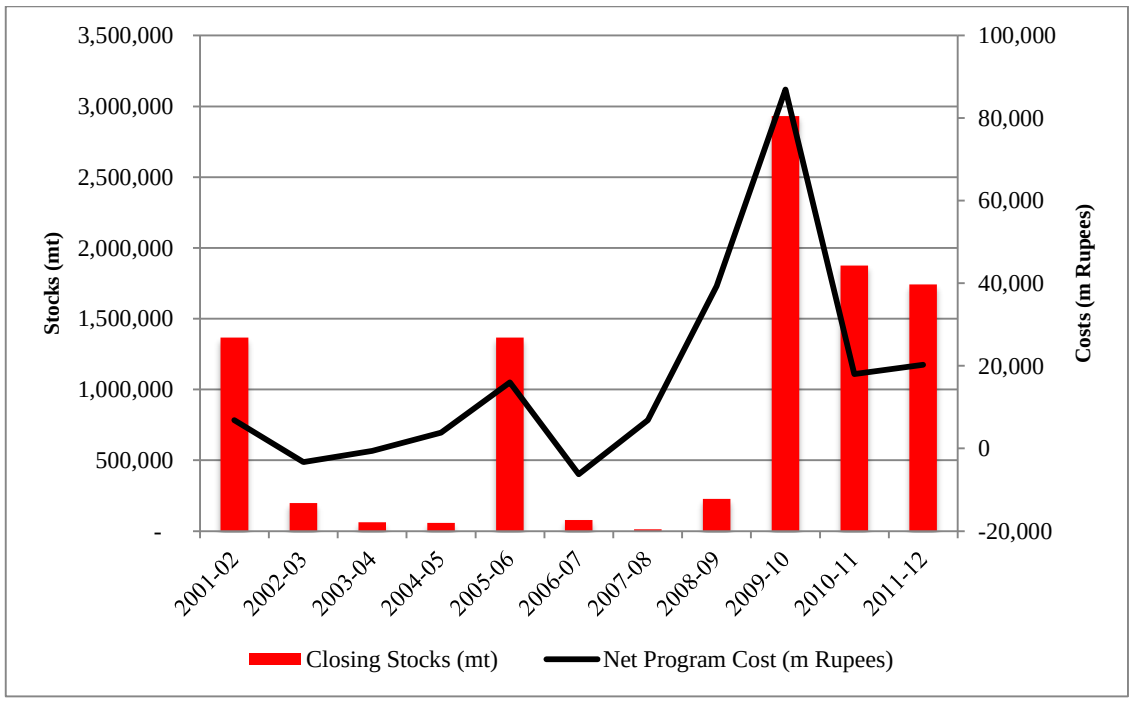
Source: Pakistan Statistical Year Book. 2012
[a]Agriculture, Food, Irrigation, Forestry and Fishing
[b]Agriculture, Irrigation, Rural Development

Figure 2.1: Punjab - wheat price stabilization costs (million Rupees)



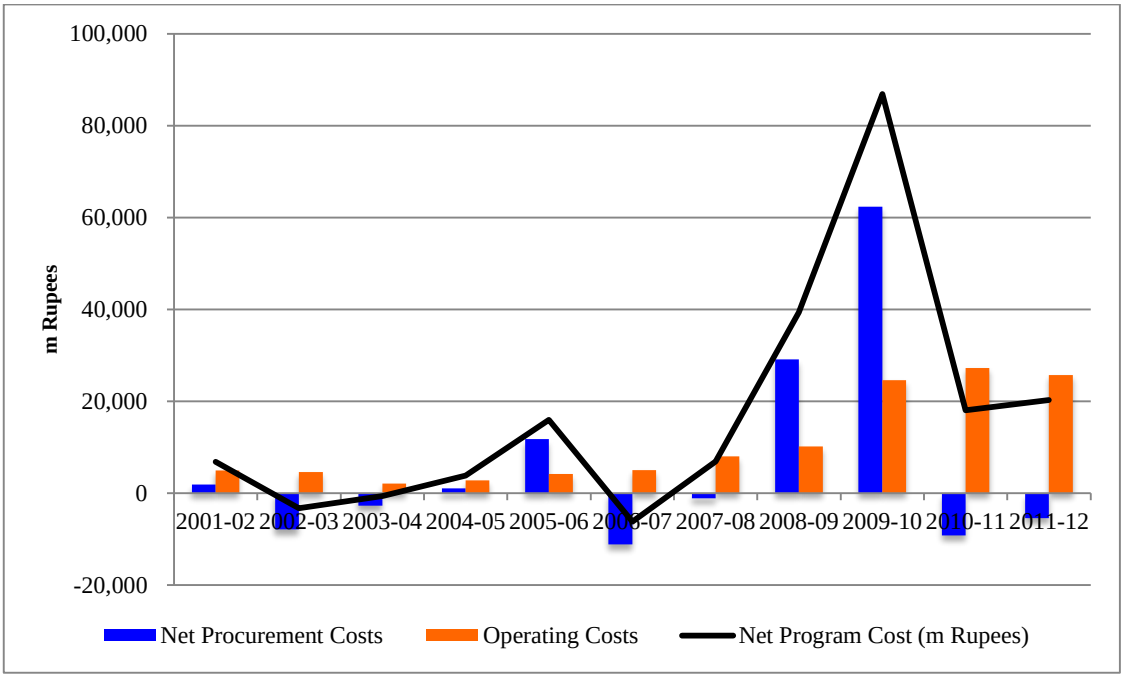
Source: Annex 1.1

Figure 2.2: Punjab - net program costs and carry-over stocks



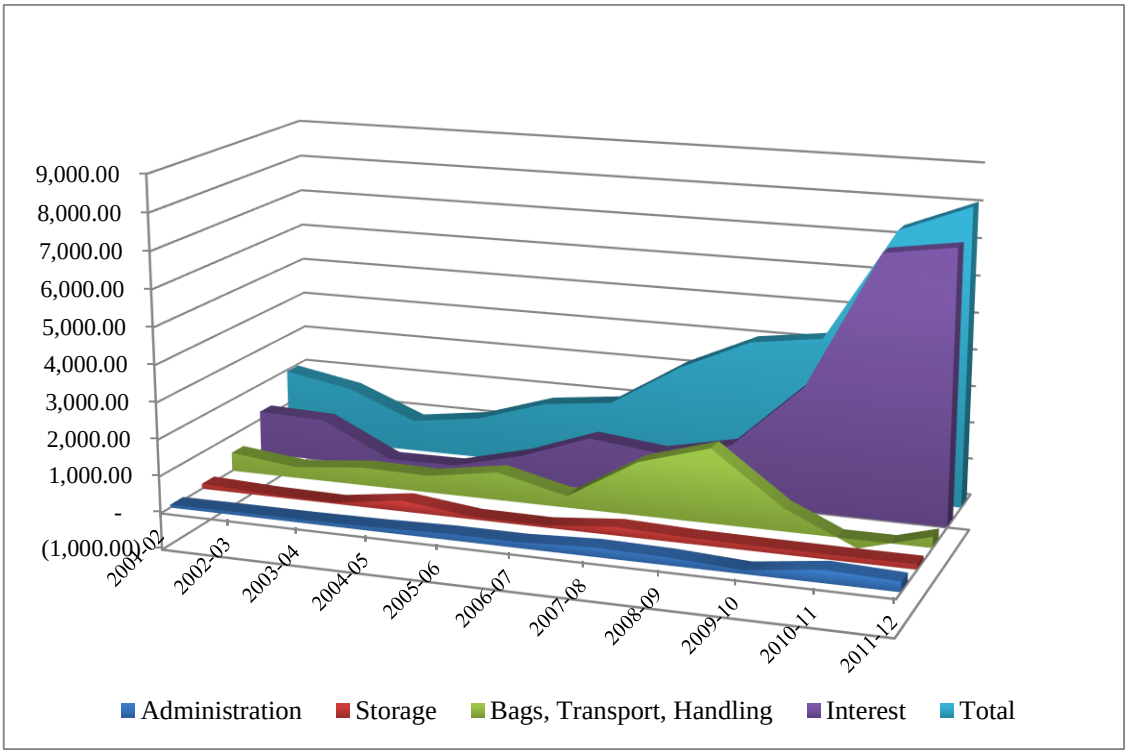
Sources: Punjab Food Department, Author's calculations

Figure 2.3: Punjab - procurement costs versus operating costs



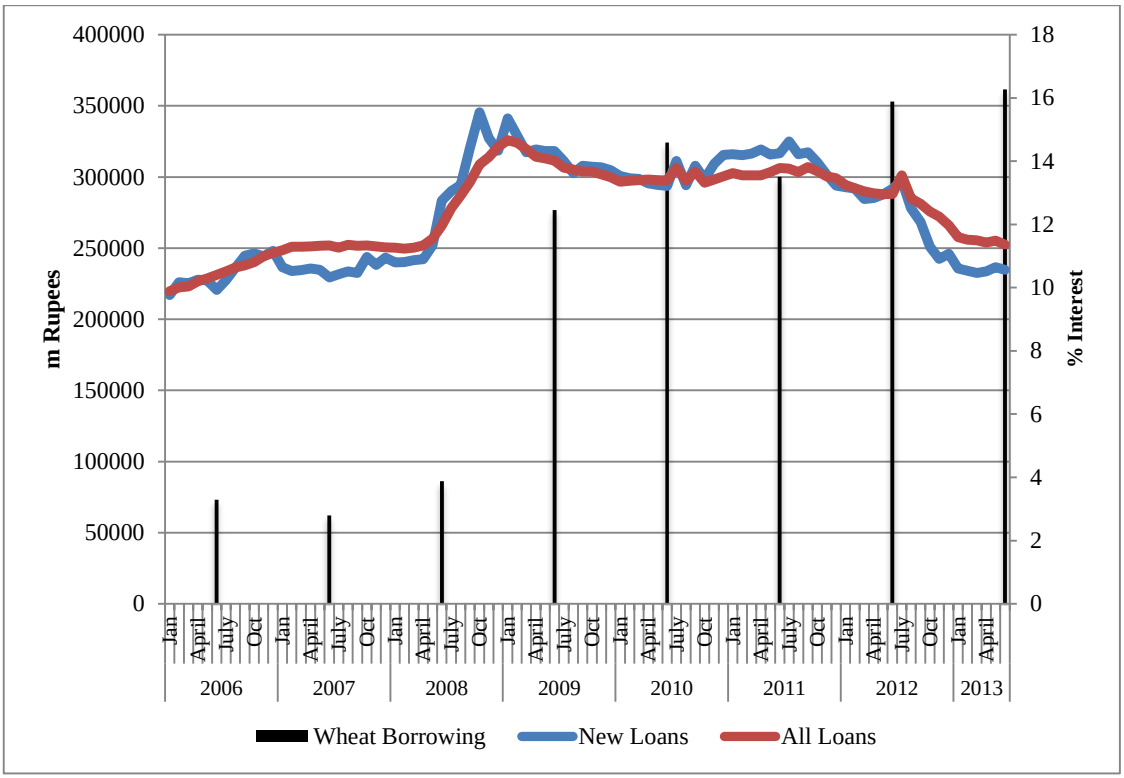
Sources: Punjab Food Department, Author's calculations

Figure 2.4: Punjab - unit operating costs (Rupees/mt procured)



Source: Punjab Food Department

Figure 2.5: Public sector borrowing for wheat commodity operations and commercial bank lending rates



Source: State Bank of Pakistan

Table 3.1: Overview of wheat-flour policies and the wheat market in Pakistan

Period	Description	Production ('000 MT)	Procurement ('000 MT)	Distribution ('000 MT)	Net Imports ('000 MT)	Net availability per capita (kg/capita)	Real wholesale price wheat (2005 Rs/kg)
1988/89 - 1999/00	Liberalized retail sales; Large-scale public imports lower market prices	15 845	3 681	5 671	2 369	132	9.05
2000/01 - 2006/07	Reduced public imports and net availability; domestic prices rise; exports to Afghanistan	19 986	4 572	4 391	-376	114	10.63
2007/08 - 2008/09	Very high world prices; domestic prices rise; exports banned; large public imports	22 127	4 170	6 052	315	118	12.96
2009/10	International prices fall; domestic prices at import parity, but little trade	24 033	9 231	5 985	147	106	15.31
2010/11 - 2012/13	Moderate rise in world prices; domestic prices at export parity; net exports	23 999	6 219	6 348	-1 463	116	12.96

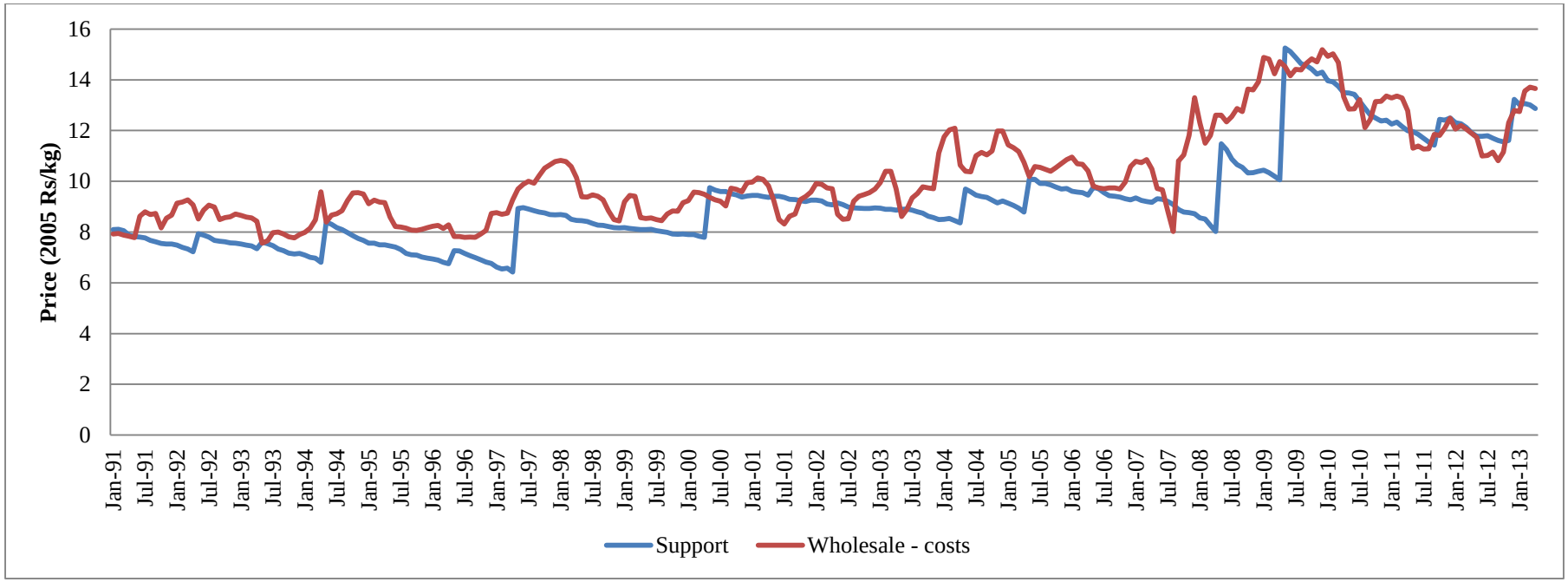
Source: Author's calculations. Production, procurement and distribution data from Pakistan Economic Survey. Trade data from Pakistan Bureau of Statistics, FAO and the UN Comtrade database (for 2011/12 and 2012/13). Lahore wholesale wheat prices from Dorosh-Salam dataset and Punjab Institute for Agricultural Marketing.
Notes: Production, procurement and distribution data are supplied for fiscal years. Production in the previous year is used to calculate net availability in the current year.

Table 3.2: Average NRA (%) for different agents along the value chain

Agent	Key assumptions	2000-2013	2000-2004	2005-2008	2009-2013
NRA to the wheat sector		-9.2%	-20.0%	-7.5%	-1.9%
Wheat farmers	Sales at support price [a]	-15.2%	-24.8%	-17.8%	-5.6%
	Sales at wholesale price – costs [b]	-8.9%	-19.7%	-7.1%	-1.7%
Wheat traders	Sales at support price [a]	6.0%	4.8%	10.2%	3.7%
	Sales at wholesale price – costs [b]	0.0%	0.0%	0.0%	0.0%
Flour millers		-4.2%	-9.4%	1.2%	-4.3%
Flour consumers	Upper bound border price [c]	12.8%	21.2%	8.8%	9.3%
	Lower bound border price [d]	4.8%	11.6%	2.5%	1.2%

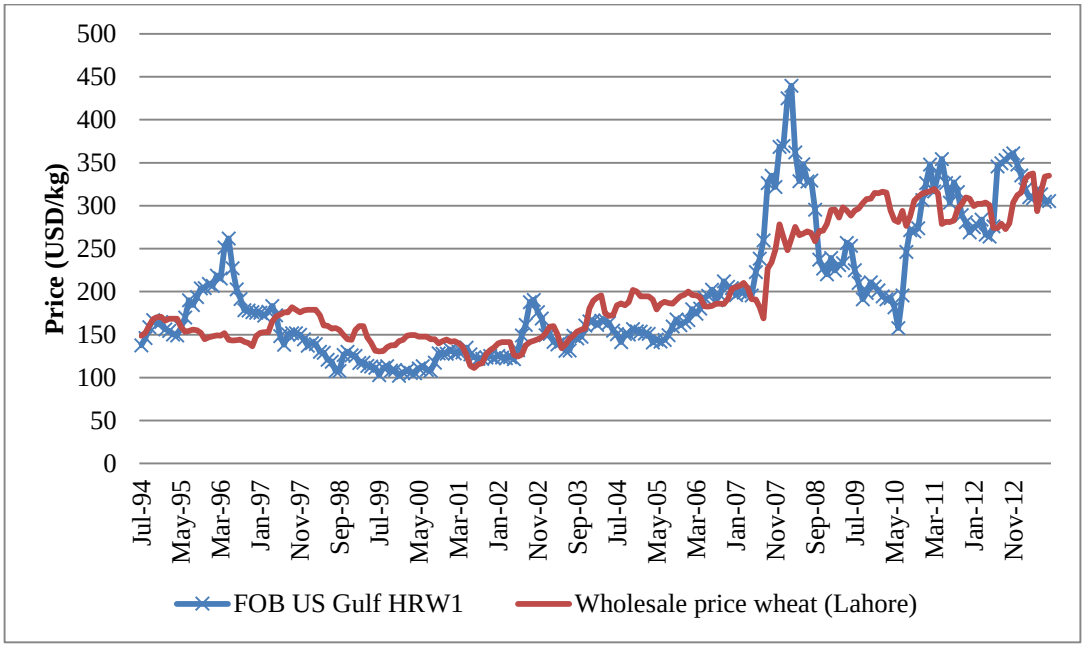
Source: Author's calculations.
Note: Years correspond to wheat crop marketing years. Hence, the year 2000 starts in May 2000 and the year 2013 ends in April 2013. The NRAs for flour millers and flour consumers are calculated assuming wheat flour imports from the EU.
a: We assume that traders pay farmers the support price, and fluctuations in the wholesale price of wheat are captured entirely by traders (see section 4.2.1).
b: We assume that traders pay farmers the wholesale price of wheat minus trader marketing costs, and fluctuations in the wholesale price are passed on entirely to farmers (see section 4.2.1).
c: We assume that marketing costs of retailers are equal to the price margin between the wholesale price and retail price of wheat flour. This assumption produces an upper bound for wheat flour border prices at the retail market and for the resulting NRAs to flour consumers (see section 4.4.1).
d: We assume that marketing costs of retailers are zero (see section 4.4.1). This assumption produces a lower bound for wheat flour border prices at the retail market and for the resulting NRAs to flour consumers (see section 4.4.1).

Figure 3.1: Real support price and wholesale price minus trader marketing costs for 1991-2013.



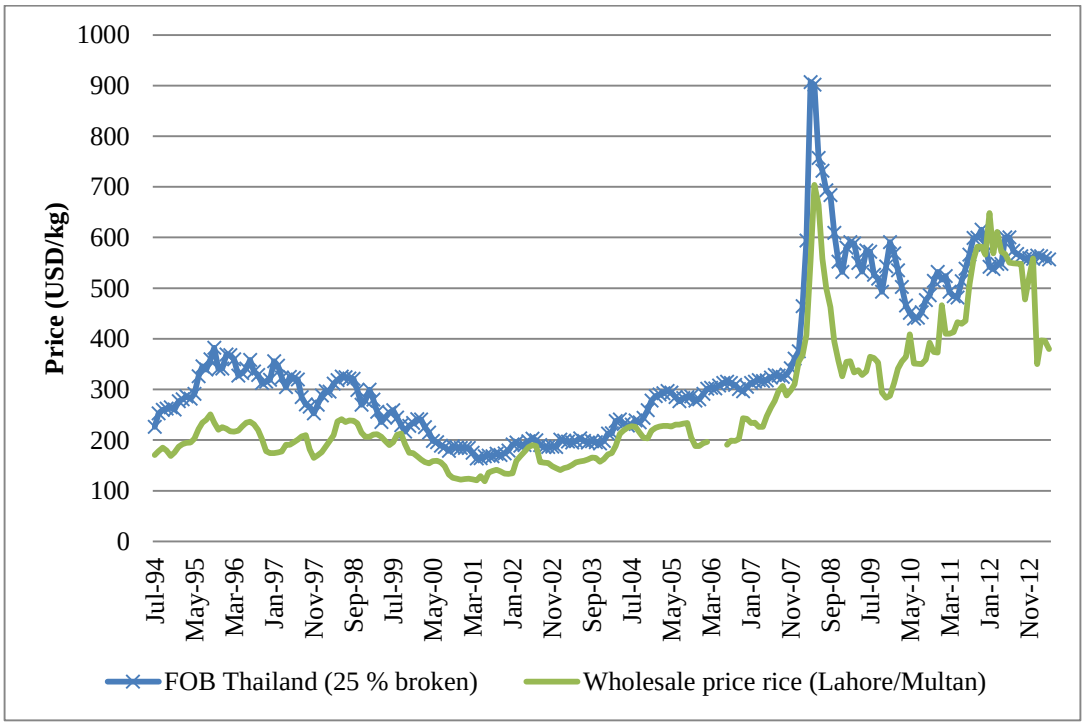
Source: Support price and Lahore wholesale wheat price from Dorosh-Salam dataset and Punjab Institute for Agricultural Marketing. Trader marketing costs calculated using data from International Finance Corporation (2011) and API and extended using the monthly Pakistan CPI.
Notes: Real prices are calculated by deflating nominal prices using the monthly Pakistan CPI (base year 2005).

Figure 3.2: International and domestic prices of wheat in Pakistan for 1994-2013.



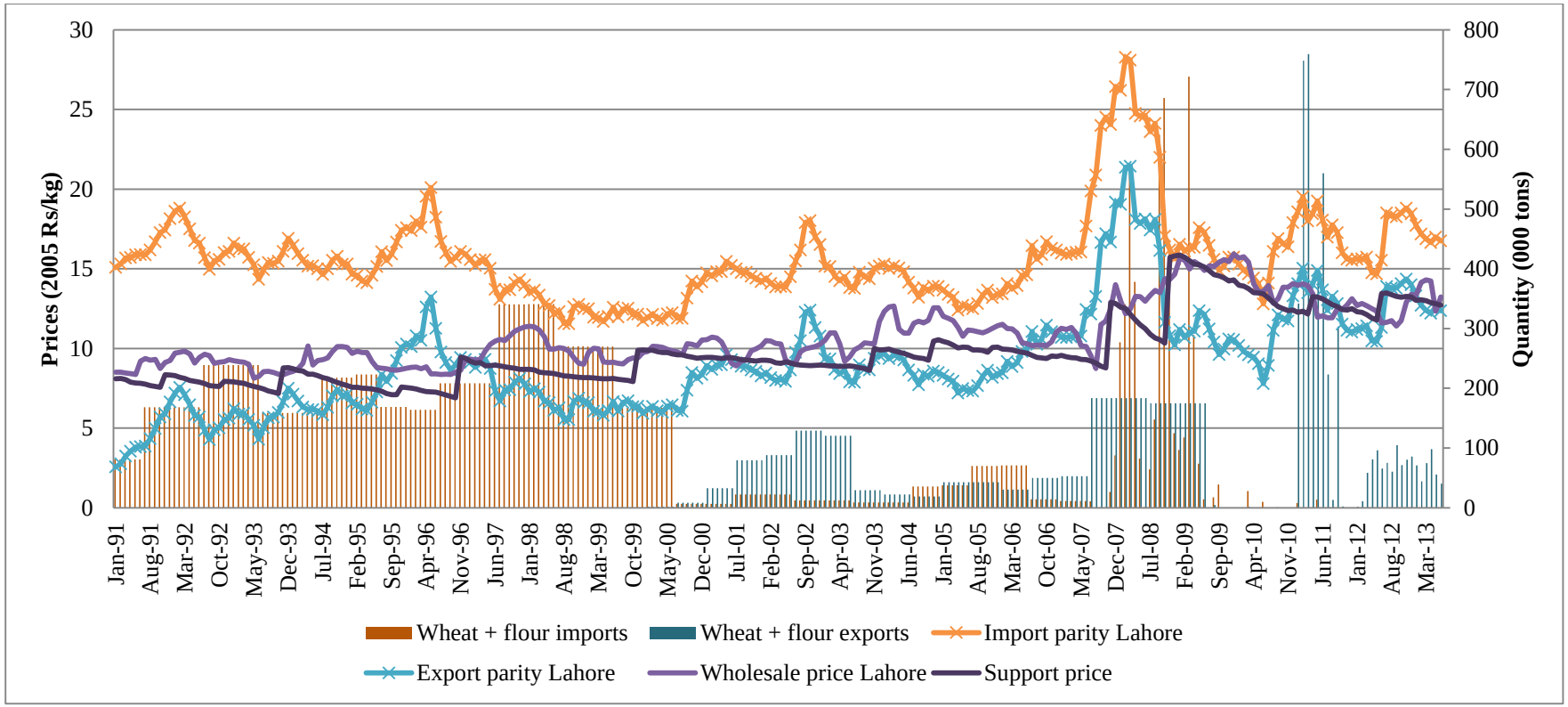
Source: International wheat price from World Bank. Wholesale prices in Lahore from Dorosh-Salam dataset and Punjab Institute for Agricultural Marketing.

Figure 3.3: International and domestic prices of rice in Pakistan for 1994-2013.



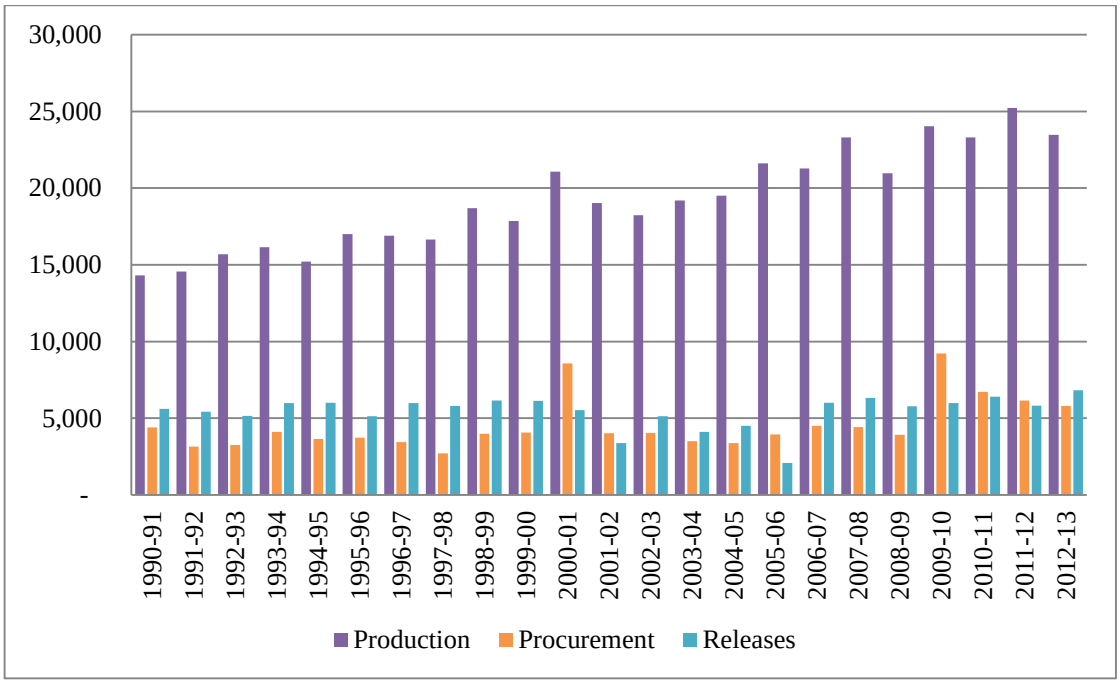
Source: International rice price from World Bank. Wholesale prices in Lahore/Multan from Pakistan Bureau of Statistics and Punjab Institute for Agricultural Marketing.

Figure 3.4: Real wheat border prices, domestic wheat prices and wheat (flour) trade for 1991-2013.



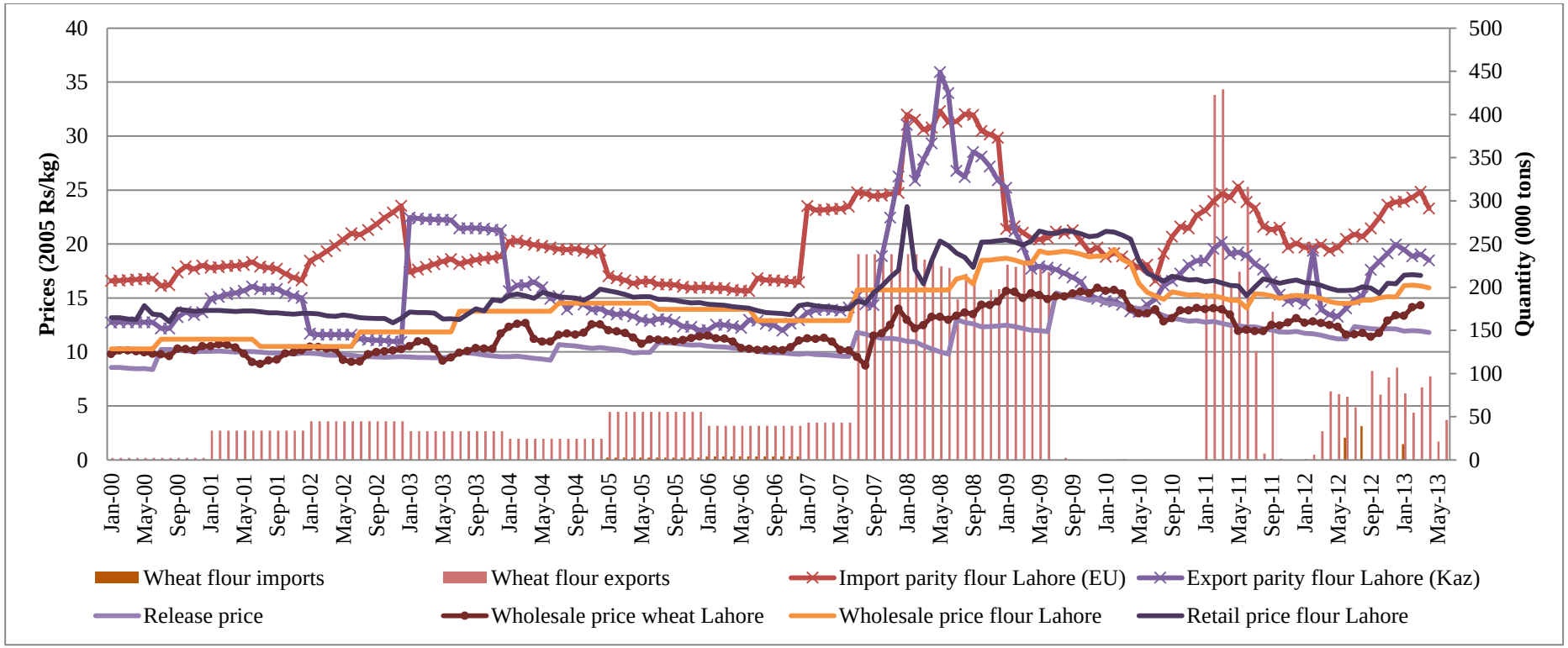
Source: Import and export parity prices for wheat from author's calculations (see Appendix 2 for details). Trade data from Pakistan Bureau of Statistics, FAO and the UN Comtrade database (for 2011/12 and 2012/13). Support price and Lahore wholesale wheat prices from Dorosh-Salam dataset and Punjab Institute for Agricultural Marketing.
Notes: Import and export parity prices shown here are measured at the wholesale market in Lahore and are calculated using the FOB price for US Gulf HRW1 wheat. The import and export parity prices used for the calculation of the NRAs are based on the FOB price for US Gulf HRW2 wheat, which is most comparable to Pakistan wheat. The reason for showing HRW1 border prices in this figure is the unavailability of US Gulf HRW2 wheat prices before January 1998. Wheat flour trade quantities are converted to wheat equivalents using a conversion factor of 0.77. Real prices are calculated by deflating nominal prices using the monthly Pakistan CPI (base year 2005).

Figure 3.5: Production, government procurement and government releases of wheat in Pakistan for 1990-2013.



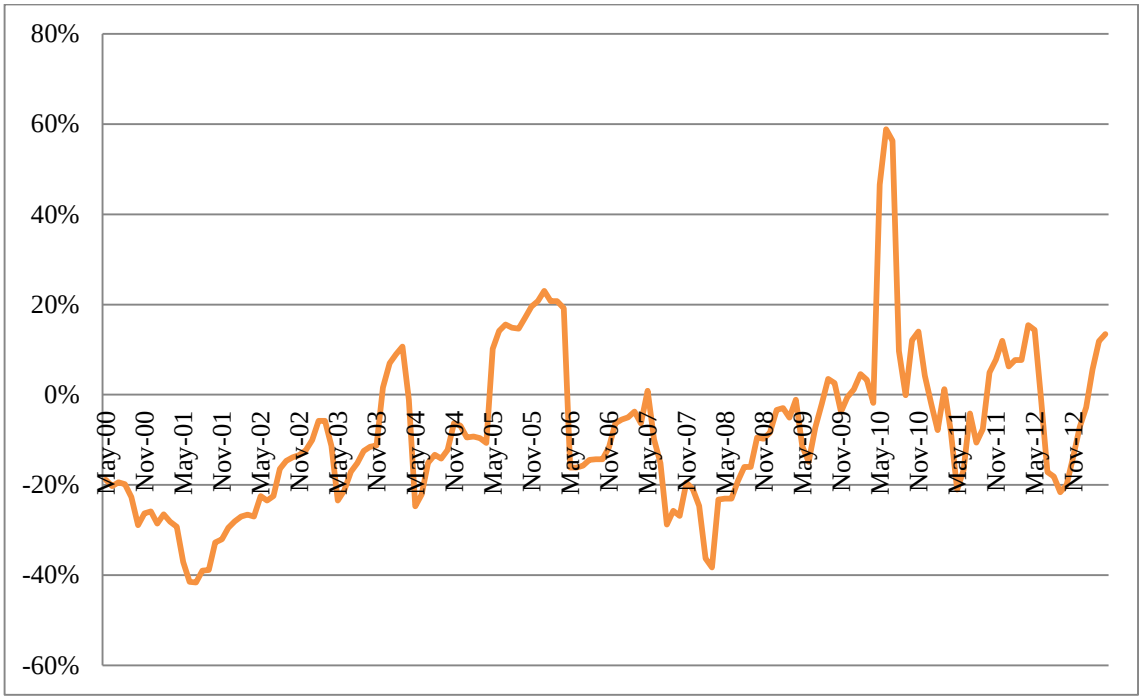
Source: Pakistan Economic Survey.
Notes: The Pakistan Economic Survey supplies production, procurement and release data by fiscal year. Hence, the figure shows data for FY1991-FY2013.

Figure 3.6: Real wheat flour border prices, domestic wheat (flour) prices and wheat flour trade for 2000-2013.



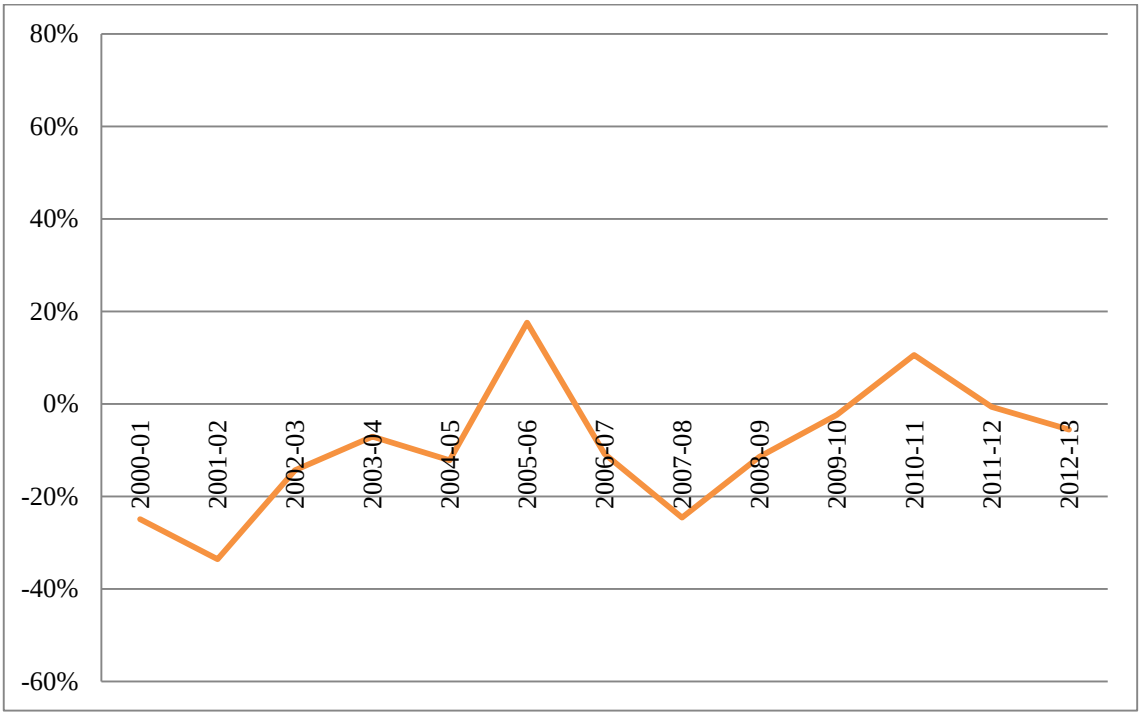
Source: Import and export parity prices for wheat flour from author's calculations (see Appendix 3 for details). Trade data from annual FAO data until 2011 and monthly data from Pakistan Bureau of Statistics for 2011-2013. Domestic prices from Dorosh-Salam dataset, Pakistan Bureau of Statistics and Punjab Institute for Agricultural Marketing. Notes: wheat flour prices are for wheat flour of superior quality. The wholesale price of wheat flour shows annual data before July 2008 (deflated by the annual CPI) and monthly data afterwards (deflated by the monthly CPI). Import parity prices are calculated assuming wheat flour imports from the EU. Import and export parity prices are measured at the wholesale market in Lahore and are used for the calculation of the NRA to flour millers. These border prices are equivalent to the lower bound parity prices used for the calculation of the NRA to flour consumers. Real prices are calculated by deflating nominal prices using the monthly Pakistan CPI (base year 2005).

Figure 3.7: Monthly NRA (%) to the wheat sector, 2000-2013.



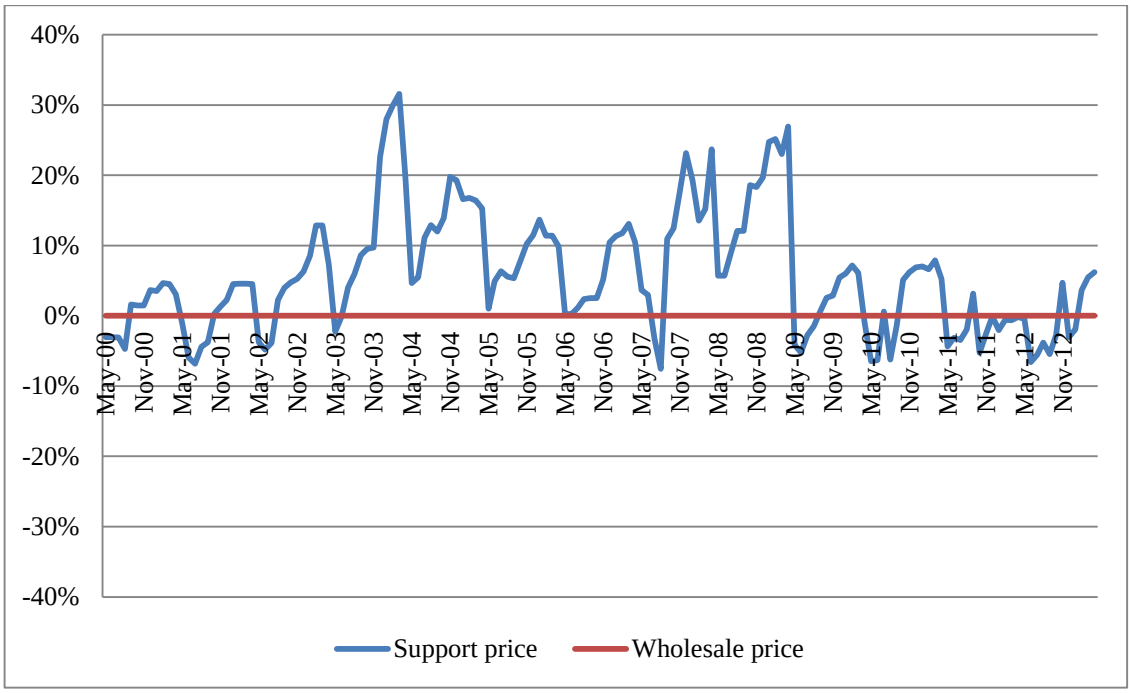
Source: Author's calculations.

Figure 3.8: NRA (%) to the wheat sector, 2000-2013.



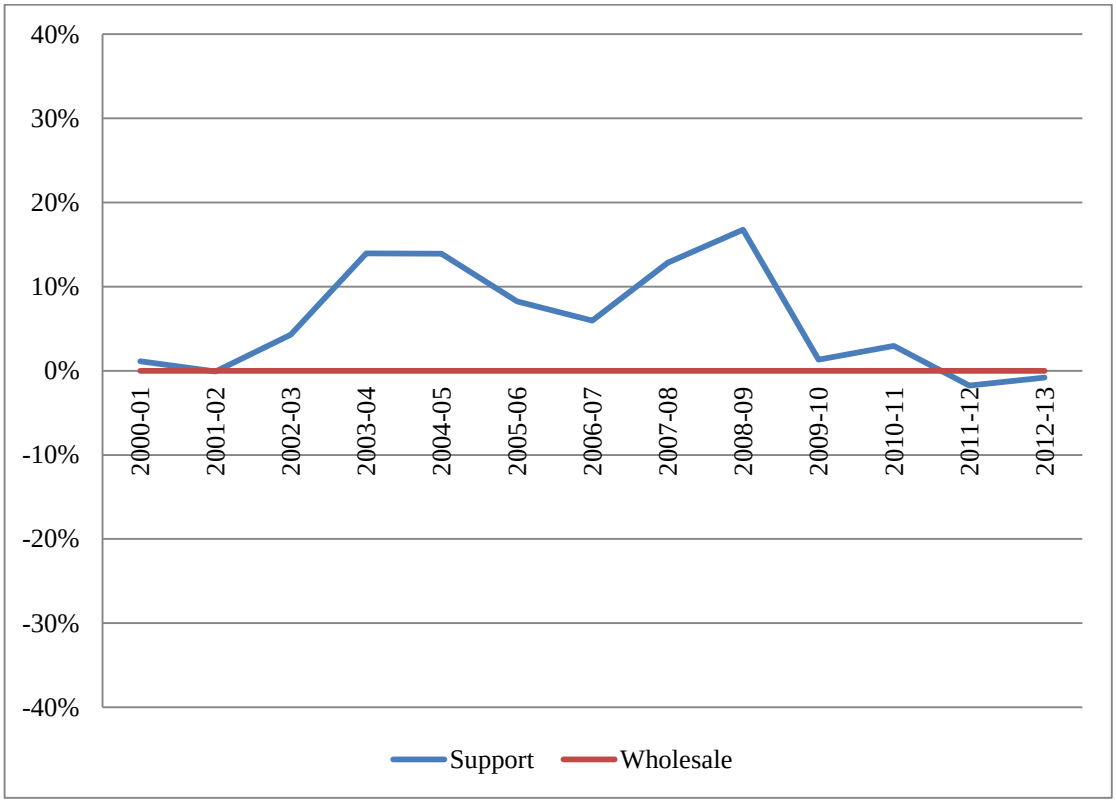
Source: Author's calculations.

Figure 3.9: Monthly NRA (%) to wheat traders for alternative farmgate price indicators, 2000-2013.



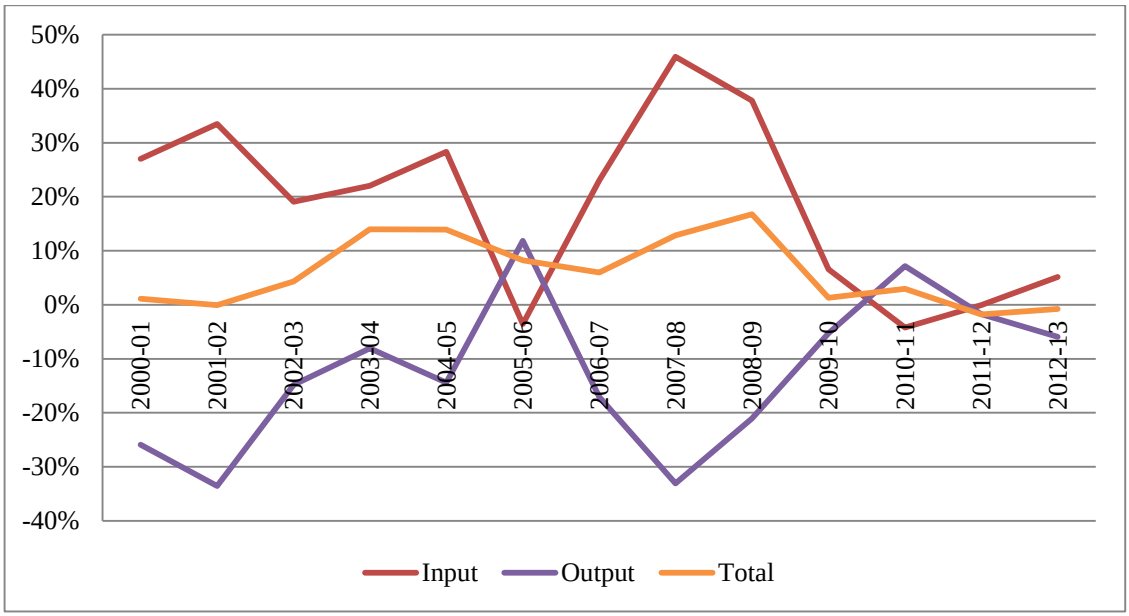
Source: Author's calculations.

Figure 3.10: NRA (%) to wheat traders for alternative farmgate prices, 2000-2013.



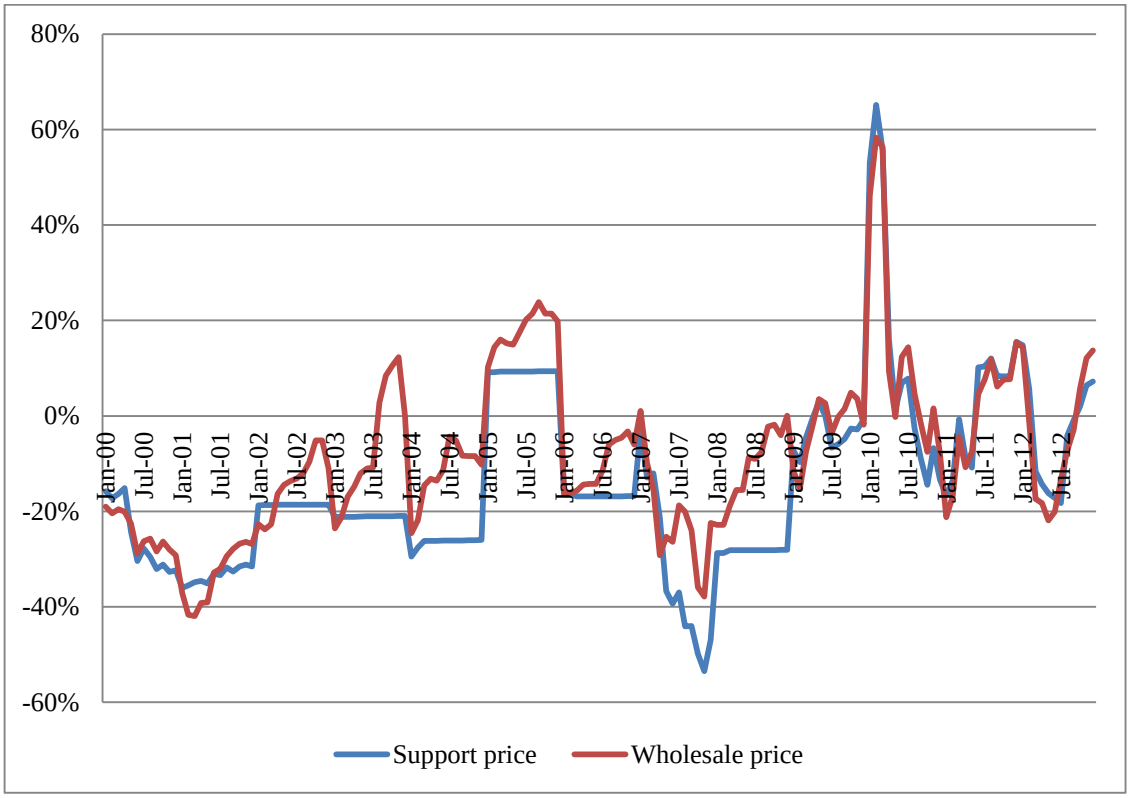
Source: Author's calculations.

Figure 3.11: NRA (%) to wheat traders (input, output, total) using support price indicator, 2000-2013.



Source: Author's calculations.

Figure 3.12: Monthly NRA (%) to wheat farmers for alternative farmgate price indicators, 2000-2013.

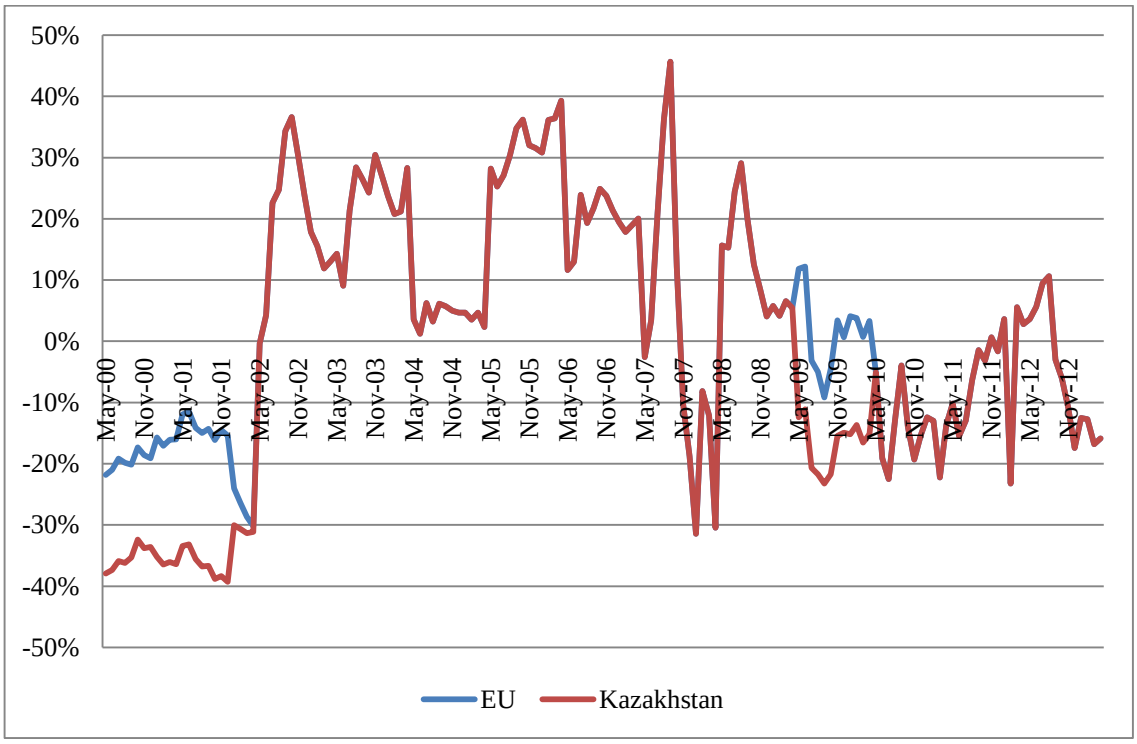


Source: Author's calculations.

Figure 3.13: NRA (%) to wheat farmers for alternative farmgate price indicators, 2000-2013.

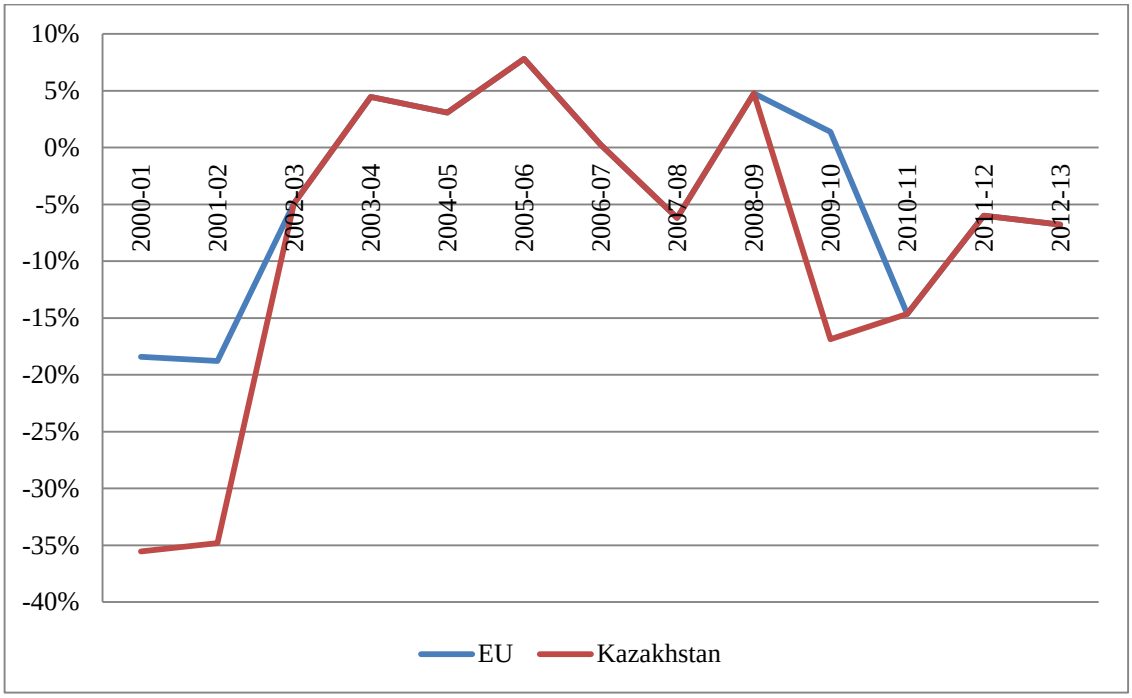
Source: Author's calculations.

Figure 3.14: Monthly NRA (%) to flour millers for alternative import parities, 2000-2013.



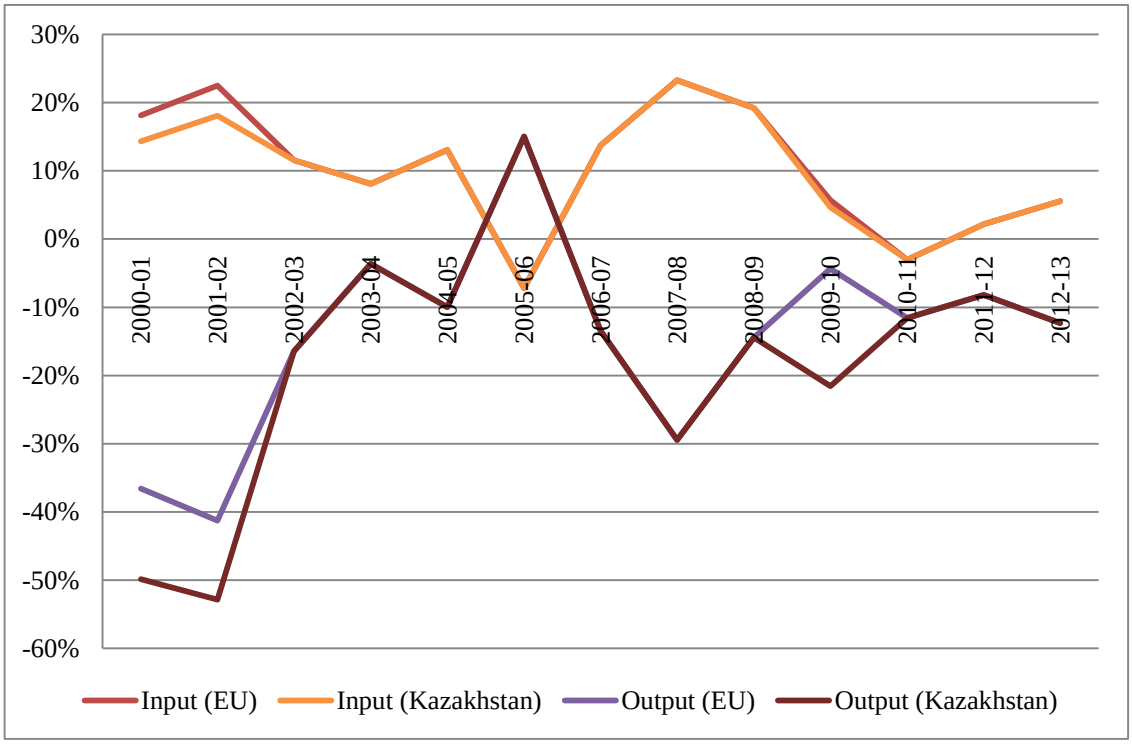
Source: Author's calculations.

Figure 3.15: NRA (%) to flour millers for alternative import parities, 2000-2013



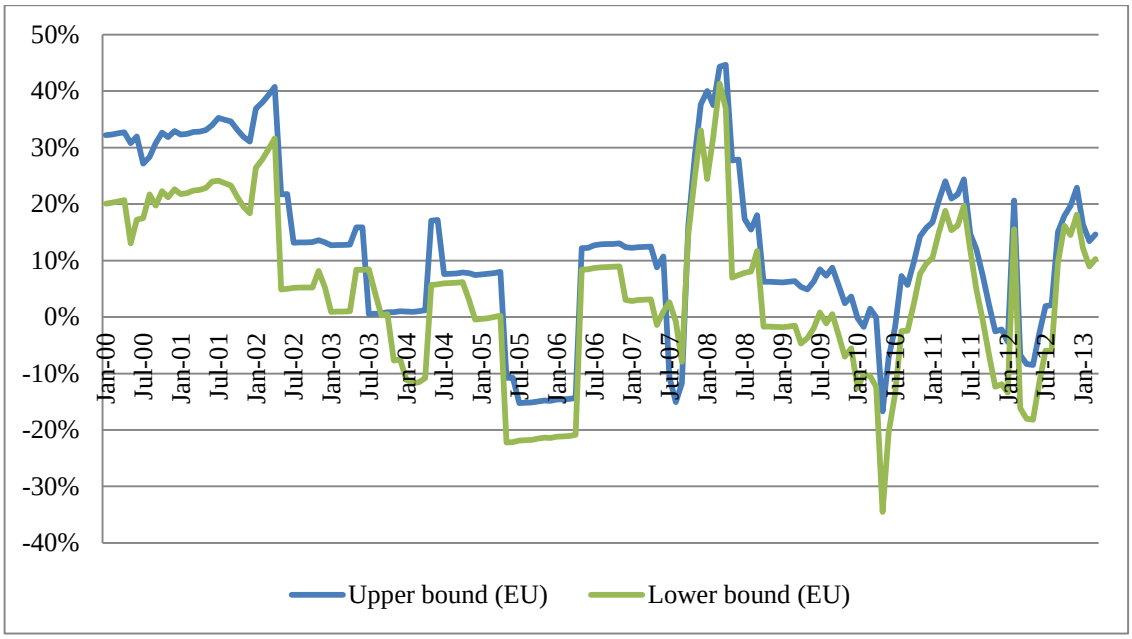
Source: Author's calculations.

Figure 3.16: NRA (%) to flour miller input and output for alternative import parities, 2000-2013



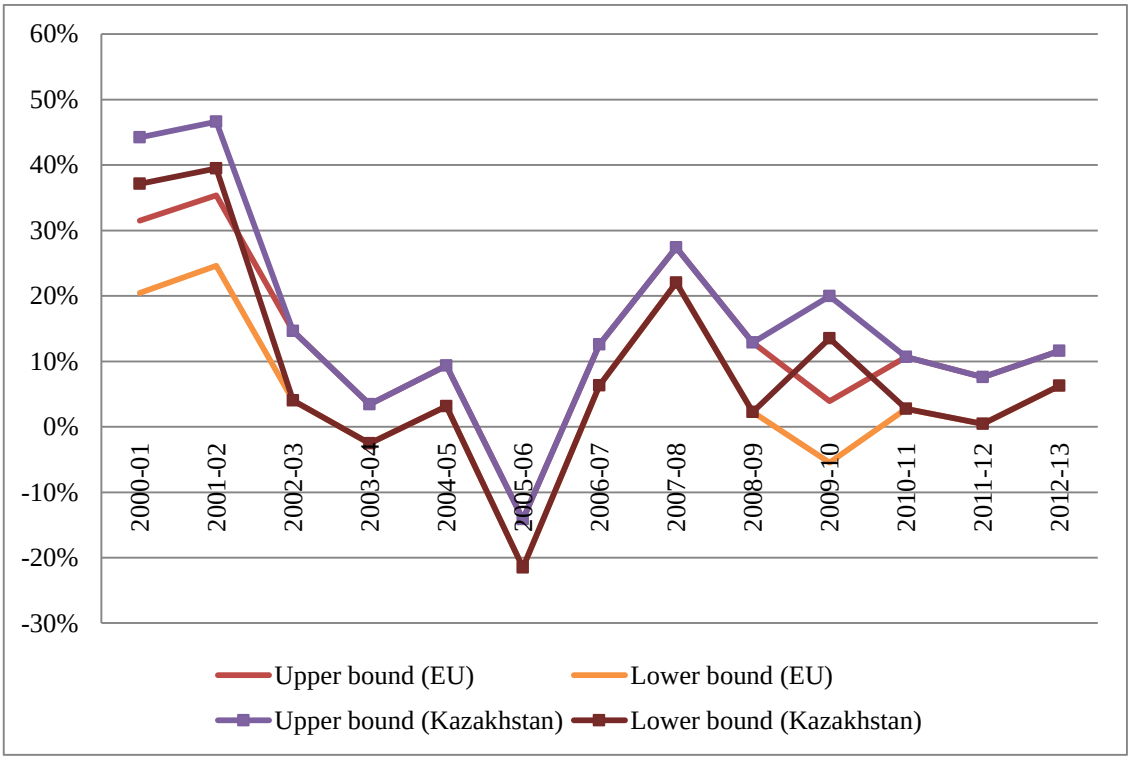
Source: Author's calculations.

Figure 3.17: Monthly NRA (%) to flour consumers for upper and lower bounds of retail border price (EU import parity prices), 2000-2013.



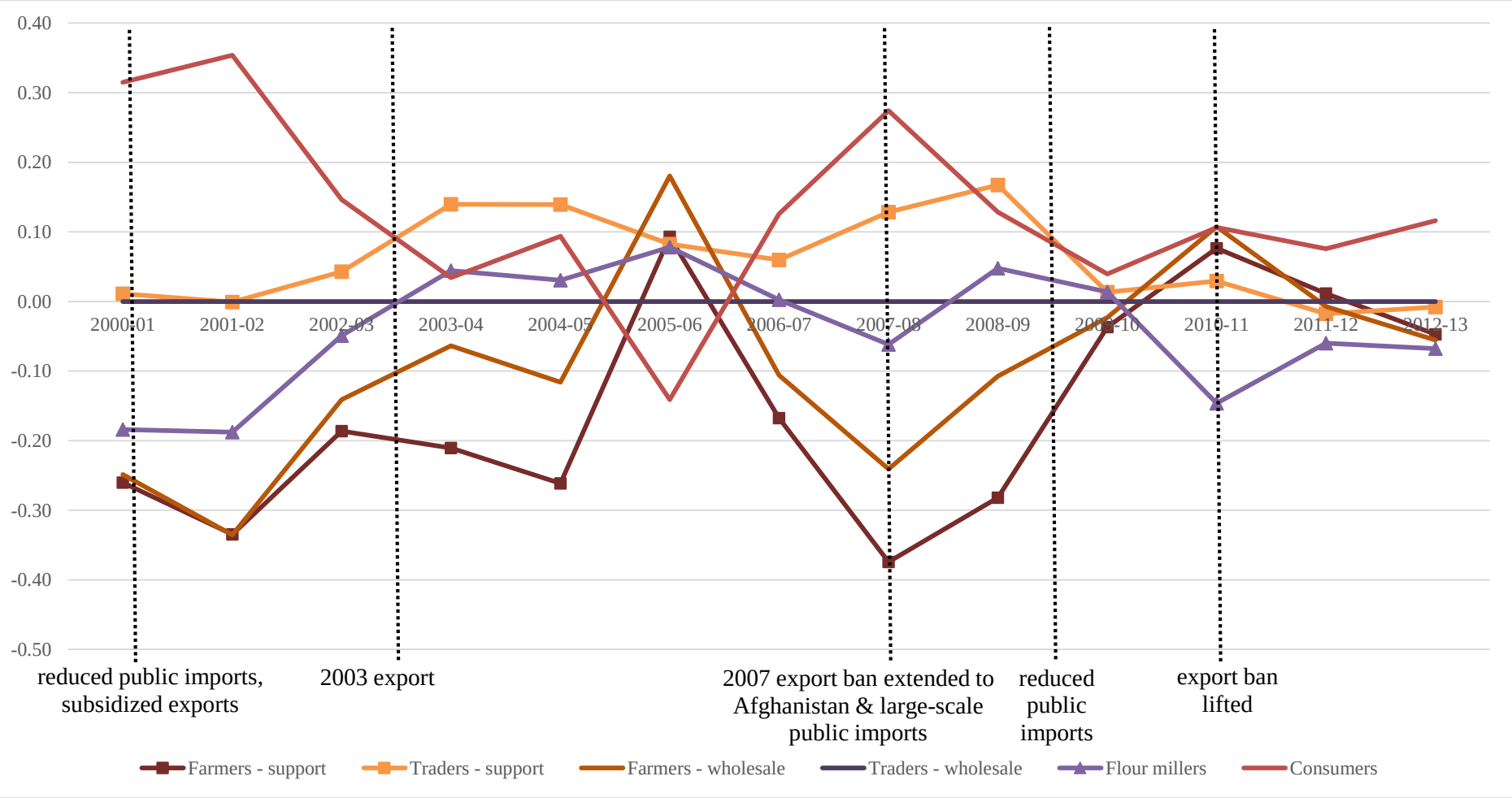
Source: Author's calculations.

Figure 3.18: NRA (%) at the level of flour consumers for upper and lower bounds of retail border price and alternative import parities, 2000-2013



Source: Author's calculations.

Figure 3.19: NRAs (%) along the value chain and major wheat (flour) policy changes in Pakistan, 2000-2013



Source: Author's calculations. Notes: NRAs to flour millers are shown for EU import parities; NRAs to consumers are shown for upper bound border prices.

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Appendix 1: Annexes to Chapter 2

Annex 1.1: Wheat price stabilization costs – Punjab province

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Opening Stocks[a] (July 1st)	1,367,939	1,366,926	197,021	61,650	58,524	1,367,274	78,587	13,606	228,317	2,930,000	1,875,000
Domestic Procurement[a] (tons)	2,514,510	2,840,643	2,408,984	2,453,094	2,438,232	2,562,832	2,568,803	2,557,401	5,781,425	3,721,797	3,191,000
Price[a] (Rupees/ton)	7,500	7,500	7,500	8,750	10,000	10,375	10,625	23,750	23,750	23,750	23,750
Procurement Cost (m Rupees)	18,859	21,305	18,067	21,465	24,382	26,589	27,294	60,738	137,309	88,393	75,786
Imports[a] (mt)	0	0	0	465,708	0	0	437,601	605,105	0	0	0
Import Price[b] (Rupees/ton)	13,147	13,212	14,434	14,041	11,188	21,290	34,552	31,513	41,686	45,917	0
Import Value (m Rupees)	0	0	0	6,539	0	0	15,120	19,069	0	0	0
Releases[a] (tons)	2,071,591	3,240,723	2,425,122	2,728,116	1,200,718	3,323,049	3,189,531	2,716,195	3,036,628	3,080,000	3,200,000
Release Price[a] (Rupees/ton)	8,000	8,000	8,437	9,875	10,500	10,958	13,652	18,656	24,687	24,687	25,000
Release Income (m Rupees)	16,573	25,926	20,461	26,940	12,608	36,414	43,543	50,673	74,965	76,036	80,000
Exports[a] (tons)	66,043	565,799	44,270	0	0	125,000	0	0	0	909,000	50,000
Export Price[b] (Rupees/ton)	5,767	5,699	6,883	8,658	0	10,882	12,929	18,283	10,518	23,712	24,379
Export Revenue (m Rupees)	381	3,225	305	0	0	1,360	0	0	0	21,554	1,219
Operating Costs[a] (m Rupees)	4,922	4,588	2,080	2,757	4,203	4,983	8,024	10,204	24,566	27,216	25,735
Net Program Cost[c] (m Rupees)	1,905	-7,846	-2,698	1,063	11,775	-11,185	-1,130	29,133	62,344	-9,198	-5,433

Sources: Punjab food department[a], author's calculations[b]

[c]A "negative program cost" indicates a net profit.

Methodology, assumptions and data for Annex 1.1

1. Procurement and Release Prices: An average price was used where these prices varied during the year.

2. Import prices were calculated as the unit (fob) prices in $US derived from FAOSTAT data and the Pakistan Statistical Yearbook 2012 (for 2011-2012), plus a margin of 15% to reflect the costs of moving grain from Karachi (port) to Lahore.

3. Export prices were calculated as the unit (cif) prices in $US derived from FAOSTAT data and the Pakistan Statistical Yearbook 2012 (for 2011-2012), less a margin of 15% to reflect the costs of moving grain from Lahore to Karachi.

4. Exchange rates ($US/rupee) were taken from World Bank Development Indicators

5. Operating costs were based on the unit operating costs provided by the Punjab Food Department (Annex 2) multiplied by the volume of domestically procured wheat.

6. Net Program Costs = Domestic Procurement + Imports – Domestic Releases – Exports – Operating Costs

Annex 1.2: Unit operating costs (Rupees/mt procured)– Punjab province

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08[a]	2008-09	2009-10	2010-11	2011-12
Administration	80.28	90.15	89.89	111.94	158.82	158.12	243.84	208.67	103.10	348.71	273.02
Department Costs	74.18	76.89	72.51	109.98	137.28	141.41	227.34	193.07	93.14	187.57	260.82
Unforeseen Expenses	4.56	3.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	144.68	0.00
Taxes and Duties	1.54	9.51	17.38	1.96	21.54	16.71	16.50	15.60	9.96	16.46	12.20
Storage	138.89	61.29	35.11	291.97	72.38	57.48	227.33	161.79	142.28	133.04	139.92
Godown Expenses	138.89	61.29	35.11	291.97	72.38	57.48	227.33	161.79	142.28	133.04	139.92
Bags, Transport, Handling	515.09	305.64	493.48	464.87	766.62	317.88	1,452.96	2,018.77	622.76	-236.65	298.46
Gunny Bags	387.73	73.05	161.67	-65.29	379.21	-76.17	446.84	844.09	191.84	-412.53	-115.57
Delivery Expenses	9.78	20.00	19.98	29.98	29.96	29.94	106.81	70.00	74.74	74.93	74.96
Handling Charges	3.89	16.46	4.14	1.86	2.19	1.87	0.86	0.57	0.09	2.71	0.80
Transport Charges	113.69	196.13	307.69	498.32	355.26	362.24	898.45	1,104.11	356.09	98.24	338.27
Interest	1,223.13	1,158.19	244.84	255.15	726.07	1,410.78	1,199.52	1,600.70	3,381.05	7,067.56	7,353.39
Bank Commission	28.18	28.19	28.20	33.49	37.58	39.02	41.72	59.31	89.66	89.34	89.34
Interest Costs	1,194.95	1,130.00	216.64	221.66	688.49	1,371.76	1,157.80	1,541.39	3,291.39	6,978.22	7,264.05
Total	1,957.39	1,615.27	863.32	1,123.93	1,723.89	1,944.26	3,123.65	3,989.93	4,249.19	7,312.66	8,064.79

Source: Punjab Food Department

[a] Costs for the year 2007-08 are for 15 months as they include the period from 1st April to 30th June of 2006-07. Prior to 2007-08 the finance department of Punjab food was providing data on the basis of a crop year (1 April to 31 March).

Appendix 2: Annexes to Chapter 3

Annex 2.1: Methodology for calculating NRA to farmer input

Annual NRAs to input are calculated using annual averages of border prices and domestic prices. Monthly NRAs are calculated using monthly import parity prices and annual domestic prices due to the unavailability of monthly domestic fertilizer prices.

The international reference prices for DAP (diammonium phosphate) and urea were taken from the World Bank. For DAP the price is the FOB US Gulf price; for urea the price is the FOB Black Sea price (primarily Yuzhnyy). World market prices were calculated by adding international ocean freight rates from the US Gulf to Karachi to the international DAP price and freight rates from the Black Sea to Karachi (estimated at 85 % of US Gulf freight rates) to the international urea price. The import parity price at Lahore is then equal to the world market price times the nominal exchange rate (Pak Rs/USD) plus import marketing costs from Karachi to Lahore. We abstract from any quality adjustments.

The conversion rates of DAP and urea (Q_j^f/Q_o^f) are equal to the number of kilograms of fertilizer used to produce one kilogram of wheat. These rates were calculated using the use of fertilizer per hectare for wheat production for 2011/12 and 2012/13 from the Agriculture Policy Institute and annual yield data for wheat taken from the Pakistan Economic Survey 2012-13. We assume that the use of fertilizer per hectare was constant over the period 2000-2013. Annual fertilizer prices are averages for Pakistan and were taken from the Pakistan Economic Survey 2012-13.

Annex 2.2: Methodology for calculating import and export parity prices for wheat

For the calculation of the import and export parity prices of wheat, we have followed Dorosh and Valdés (1990) and Dorosh and Salam (2007).

The import parity price for wheat

The CIF price at the border in Karachi equals the international price of wheat (US FOB Gulf HRW2) plus international freight costs from the US Gulf to Karachi times the nominal exchange rate (Pak Rs/USD). The import parity price at the wholesale market in Lahore equals the CIF price at the border in Karachi (adjusted for a quality difference of 5 %) plus import and domestic marketing costs from Karachi to the wholesale market in Lahore. The import parity price at the farmgate equals the import parity at the wholesale market minus marketing costs from the farmgate to the wholesale market in Lahore.

The export parity price for wheat at the farmgate

The FOB price at the border of Karachi equals the international price of wheat (US FOB Gulf HRW2) plus international freight costs from Karachi to the Middle East/South Asia times the nominal exchange rate (Pak Rs/USD). The export parity price at the wholesale market in Lahore equals the FOB price at the border in Karachi minus export and domestic marketing costs from Karachi to the wholesale market in Lahore. The export parity price at the farmgate in Lahore equals the export parity price at the wholesale market minus marketing costs from the farmgate to the wholesale market in Lahore.

The monthly international wheat price for US Gulf HRW2 was taken from the FAO commodity price database and the official nominal exchange rate was taken from the IMF International Finance Statistics. Import and export marketing costs include insurance, landing and handling costs, commissions for the Trading Corporation Pakistan (TCP), interest costs and other miscellaneous expenses. Marketing costs before 2005/06 were taken from the Dorosh and Salam (2007) dataset; marketing costs for the years after were taken from the Agricultural Policy Institute (API). International freight rates from the US Gulf to Karachi were taken from the Dorosh-Salam dataset for 2000-2006 and from IGC for 2007-2013. International freight rates from Karachi to the Middle East/South Asia were estimated to be 75 % of freight rates from the US Gulf to Karachi.

Annex 2.3: Methodology for calculating border prices for wheat flour

Autarky prices
Autarky prices are calculated by adding marketing and processing costs of flour milling in Pakistan to the autarky wholesale wheat price in Lahore. Marketing and processing costs for 2010/11 were taken from (International Finance Corporation 2011) and extended using the monthly CPI. Marketing costs include transportation, handling and service fees to traders.

Import and export parity prices
The calculation of import and export parity prices for wheat flour is not straightforward. Contrary to wheat grain, wheat flour is not a widely-traded commodity with a clearly identified international reference price. We have therefore calculated an import parity price for two scenario's.

In the first scenario, we assume that Pakistan would import wheat flour from Kazakhstan under free trade. Kazakhstan has recently become one of the global leaders in wheat flour exports and the main supplier of wheat flour to the Central and South Asia region. As Kazakhstan has historically been the main supplier of wheat flour to the north of Afghanistan (Persaud 2013), wheat flour from Kazakhstan should be able to reach Pakistan as well. In this scenario, the import parity price of wheat flour at Lahore is equal to the Kazakhstan wheat flour FOB price (times the Pakistan Rs./USD nominal exchange rate) plus marketing costs from Kazakhstan to Lahore, adjusted for a quality difference of 5 %.

The second scenario assumes that Pakistan would import wheat flour from the EU or Black Sea region under free trade. Wheat flour imported from the EU/Black Sea region would likely be less costly for Pakistan than importing wheat flour from Kazakhstan due to significant land freight costs for the latter. In addition, since 2003 a large share of wheat flour imports (although mainly in the form of humanitarian aid or food aid) has come from the EU-27, Turkey or Ukraine. For the EU/Black Sea region, we use the FOB export price of Turkey, the second global leader in wheat flour exports, as the international reference price. The import parity price at Lahore is then equal to the Turkey wheat flour FOB price plus international ocean freight costs from the EU/Black Sea region to South Asia (times the nominal exchange rate) plus marketing costs from Karachi to Lahore, adjusted for a quality difference of 5 %.

According to UN Comtrade statistics, in 2003-2013 over 90 % of wheat flour exports from Pakistan have flowed to Afghanistan (with the exception of 2011 where the share is 75 %, see Section 2). We therefore assume that under free trade Pakistan would continue to export wheat flour mostly to Afghanistan and that the export parity price is mainly determined by demand in Afghanistan (see also World Bank, 2010: 124, footnote 88). As Kazakhstan is the leading wheat flour exporter in the region and the main competitor of Pakistan flour exports in Afghanistan, we take the FOB wheat flour price of Kazakhstan as the international reference price. The export parity price of wheat flour at Lahore is then equal to the Kazakhstan FOB wheat flour price plus freight rates from Kazakhstan to the Pakistan-Afghanistan border minus transport and marketing costs from Lahore to the border (Peshawar).

The unit value FOB wheat flour price for Turkey and Kazakhstan is calculated using annual UN Comtrade wheat flour trade statistics for the years 2000-2003 and monthly GTIS wheat flour trade

data for the years 2004-2013. International ocean freight rates from the EU/Black Sea region to South Asia is estimated to be 85 % of US Gulf – Karachi freight rates, which are taken from the Dorosh-Salam dataset for 2000-2006 and from IGC Grain Market Reports for 2007 onwards. Annual marketing costs from the Kazakhstan border to Kabul were taken from official statistics for 2011 and extended using the annual Kazakhstan CPI (base year 2005). Marketing costs from Kabul to the Afghanistan-Pakistan border (Peshawar) were calculated from estimates for 2002 in Chabot and Dorosh (2007) and for 2012 in Food Security Response Analysis Support Team Afghanistan (RASTA), (2014). Both series were extended using the monthly Pakistan CPI. Marketing costs from Lahore to the Afghanistan-Pakistan border (Peshawar) were calculated from estimates for 2012 in (RASTA, 2014) and extended using the monthly Pakistan CPI.

Annex 2.4: Additional tables and figures

Table A2.1: World Bank estimates of NRA, NRA to output and NRA to input for wheat, 2000-2010.

Year	NRA	NRA to output	NRA to input
2000	0.093	0.073	0.020
2001	-0.146	-0.178	0.032
2002	-0.266	-0.287	0.021
2003	-0.290	-0.302	0.012
2004	-0.132	-0.150	0.018
2005	-0.095	-0.124	0.029
2006	-0.315	-0.315	0.000
2007	-0.484	-0.484	0.000
2008	-0.634	-0.634	0.000
2009	-0.017	-0.017	0.000
2010	-0.028	-0.028	0.000

Source: World Bank Updated Distortions to Agricultural Incentives database (Anderson and Nelgen, 2013).

Table A2.2: Calculation of NRA to wheat farmers (prices in Rs/kg)

Marketing Year	Border price	Support price	Wholesale wheat - trader costs	Import parity farmgate	Export parity farmgate	Autarky price farmgate	NRA support	NRA wholesale	NRA input
2000/01	Import	7.50	7.62	10.45	5.87	4.76	-0.26	-0.25	0.02
2001/02	Import	7.50	7.49	11.50	6.74	6.74	-0.33	-0.34	0.01
2002/03	Autarky	7.50	7.92	12.85	8.03	9.38	-0.19	-0.14	0.01
2003/04	Autarky	7.50	8.93	12.48	7.52	9.76	-0.21	-0.06	0.02
2004/05	Autarky	8.75	10.55	12.64	7.55	12.42	-0.26	-0.12	0.03
2005/06	Autarky	10.00	10.84	13.33	8.18	9.63	0.09	0.18	0.05
2006/07	Autarky	10.38	11.22	17.53	11.83	13.64	-0.17	-0.11	0.07
2007/08	Export	10.63	13.33	28.61	20.31	16.75	-0.37	-0.24	0.10
2008/09	Autarky	15.63	20.12	28.62	20.21	25.77	-0.28	-0.11	0.11
2009/10	Import	23.75	24.10	25.51	17.03	15.64	-0.04	-0.02	0.03
2010/11	Export	23.75	24.46	31.57	22.74	23.52	0.08	0.11	0.03
2011/12	Export	25.21	24.74	34.39	25.20	23.80	0.01	-0.01	0.01
2012/13	Export	27.81	27.57	39.39	29.39	31.21	-0.05	-0.06	0.01

Source: Author's calculations. Wholesale price wheat at Lahore from Dorosh-Salam dataset and Punjab Institute for Agricultural Marketing. Notes: Appendix 2 provides details on the calculation of import and export parity prices for wheat. Autarky prices supplied by P. Dorosh.

Table A2.3: Calculation of NRA to wheat traders (prices in Rs/kg)

Marketing year	NRA input support	NRA input wholesale	Wholesale wheat Lahore	Import parity wheat Lahore	Export parity wheat Lahore	Autarky price wheat Lahore	NRA output	NRA support	NRA wholesale
2000/01	0.27	0.26	8.08	10.90	6.33	5.22	-0.26	0.01	0.00
2001/02	0.33	0.34	7.95	11.97	7.21	7.21	-0.34	0.00	0.00
2002/03	0.19	0.15	8.40	13.33	8.51	9.86	-0.15	0.04	0.00
2003/04	0.22	0.08	9.43	12.98	8.02	10.26	-0.08	0.14	0.00
2004/05	0.28	0.14	11.10	13.18	8.09	12.96	-0.14	0.14	0.00
2005/06	-0.04	-0.12	11.42	13.91	8.76	10.21	0.12	0.08	0.00
2006/07	0.23	0.17	11.75	18.06	12.36	14.17	-0.17	0.06	0.00
2007/08	0.46	0.33	14.13	29.41	21.10	17.54	-0.33	0.13	0.00
2008/09	0.38	0.21	21.21	29.71	21.30	26.86	-0.21	0.17	0.00
2009/10	0.05	0.05	25.32	26.73	18.25	16.87	-0.05	0.01	0.00
2010/11	-0.04	-0.07	25.77	32.89	24.06	24.83	0.07	0.03	0.00
2011/12	0.00	0.02	26.07	35.73	26.53	25.13	-0.02	-0.02	0.00
2012/13	0.05	0.06	28.93	40.75	30.76	32.58	-0.06	-0.01	0.00

Source: Author's calculations. Wholesale price wheat at Lahore from Dorosh-Salam dataset and Punjab Institute for Agricultural Marketing. Notes: Appendix 2 provides details on the calculation of import and export parity prices for wheat. Autarky prices supplied by P. Dorosh.

Table A2.4: Calculation of NRA to flour millers for EU import parity prices (prices in Rs/kg)

Marketing Year	Release price	Wholesale price flour Lahore	Import parity flour Lahore (EU)	Export parity flour Lahore	Autarky price flour Lahore	NRA input (EU)	NRA output (EU)	NRA (EU)
2000/01	7.75	8.64	13.62	10.76	6.86	0.18	-0.37	-0.18
2001/02	8.00	8.57	14.59	11.52	8.89	0.22	-0.41	-0.19
2002/03	8.00	9.69	17.02	12.44	11.60	0.12	-0.16	-0.05
2003/04	8.36	11.62	16.58	17.16	12.06	0.08	-0.04	0.04
2004/05	9.64	13.44	17.55	13.47	14.93	0.13	-0.10	0.03
2005/06	10.78	14.20	16.49	12.86	12.34	-0.07	0.15	0.08
2006/07	10.96	14.24	20.67	14.37	16.46	0.14	-0.13	0.00
2007/08	13.18	18.28	32.41	25.91	20.06	0.23	-0.29	-0.06
2008/09	17.82	25.61	41.01	38.77	29.93	0.19	-0.14	0.05
2009/10	23.68	31.44	32.86	26.36	20.30	0.06	-0.04	0.01
2010/11	24.69	28.80	40.04	32.58	28.57	-0.03	-0.12	-0.15
2011/12	24.95	31.41	44.45	34.20	29.05	0.02	-0.08	-0.06
2012/13	27.08	34.58	51.01	39.44	36.82	0.06	-0.12	-0.07

Source: Author's calculations. Release price from Dorosh-Salam dataset. Wholesale price wheat flour at Lahore from Pakistan Bureau of Statistics.
Notes: Appendix 3 provides details on the calculation of wheat flour border prices. The wholesale wheat flour price is for wheat flour of superior quality.

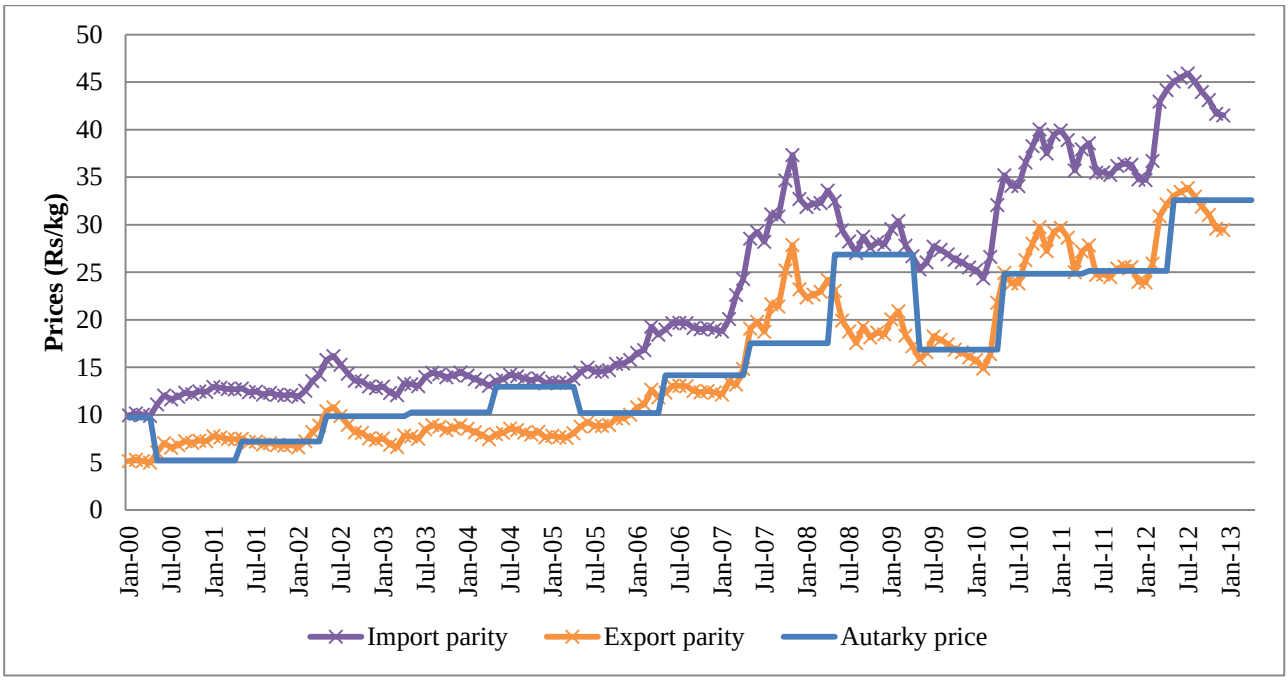
Table A2.5: Calculation of NRA to flour consumers for EU import parity prices (prices in Rs/kg)

Marketing Year	Retail price wheat flour	Upper import parity flour (EU)	Upper export parity flour	Upper autarky price flour	Lower import parity flour (EU)	Lower export parity flour	Lower Autarky price flour	NRA Upper	NRA Lower
2000/01	10.83	15.81	12.95	9.05	13.62	10.76	6.86	0.31	0.20
2001/02	11.00	17.02	13.95	11.33	14.59	11.52	8.89	0.35	0.25
2002/03	11.14	18.47	13.88	13.05	17.02	12.44	11.60	0.15	0.04
2003/04	12.36	17.32	17.90	12.80	16.58	17.16	12.06	0.03	-0.03
2004/05	14.46	18.57	14.49	15.95	17.55	13.47	14.93	0.09	0.03
2005/06	15.00	17.30	13.67	13.14	16.49	12.86	12.34	-0.14	-0.22
2006/07	15.42	21.84	15.55	17.63	20.67	14.37	16.46	0.13	0.06
2007/08	20.21	34.35	27.85	22.00	32.41	25.91	20.06	0.27	0.22
2008/09	29.26	44.66	42.41	33.57	41.01	38.77	29.93	0.13	0.02
2009/10	34.67	36.09	29.58	23.53	32.86	26.36	20.30	0.04	-0.05
2010/11	31.68	42.92	35.46	31.45	40.04	32.58	28.57	0.11	0.03
2011/12	34.04	47.08	36.84	31.69	44.45	34.20	29.05	0.08	0.00
2012/13	36.98	53.40	41.83	39.22	51.01	39.44	36.82	0.12	0.06

Source: Author's calculations. Retail wheat flour price at Lahore from Pakistan Bureau of Statistics.

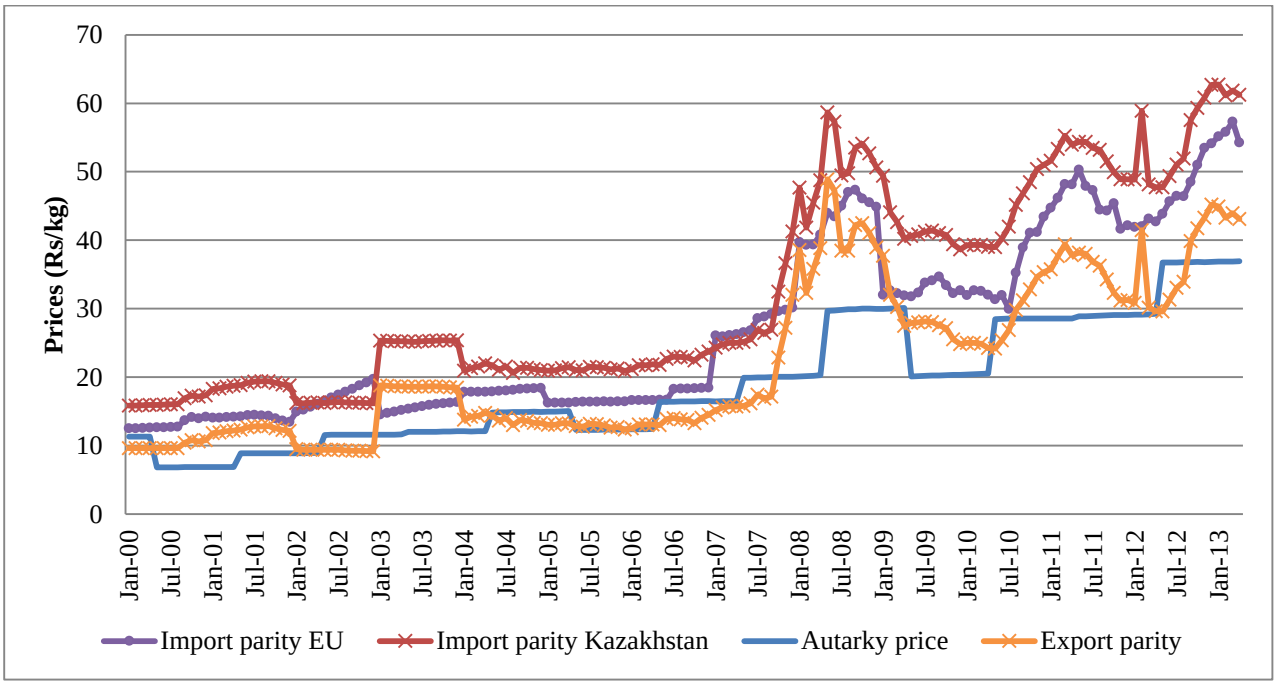
Notes: The wheat flour retail price is the price for wheat flour of superior quality.

Figure A2.1: Import parity, export parity and autarky prices for wheat for 2000-2013.



Source: Import and export parity prices based on author's calculations (see Appendix 2 for details). Autarky prices were supplied by P. Dorosh.

Figure A2.2: Import parities, export parity and autarky prices for wheat flour for 2000-2013.



Source: Author's calculations. Appendix 3 provides details on the calculation of wheat flour border prices. Notes: wheat flour border prices and autarky prices are measured at the wholesale market in Lahore. These border prices correspond to the lower bound border prices at the retail market used for calculations of the NRA to flour consumers.

Appendix 3: Analysis of price dynamics and impact of government wheat release policy on wheat (flour) prices

Volatile and uncertain food prices and temporary problems with access to affordable food can impose significant economic and social costs on society. Prices of food staples are of particular importance in the context of ensuring access to food.

Wheat and rice are the main food staples in Pakistan. Wheat production is close to self-sufficiency in most years, while a high proportion of rice is exported. Inadequate food availability is thus rarely a problem, and is not usually a source of food price instability. Reduced access to staple foods is the major outcome of increased prices and/or price instability.

One of the main declared goals of the Wheat Price Stabilization policy of Pakistan is maintaining wheat affordability and price stability. This appendix first analyzes the existing degree of price co-integration across regions and within the value chain for wheat (flour) and rice prices in Pakistan, and then examines the impact of government wheat releases to flour mills - one of the main instruments of the Wheat Price Stabilization policy – on domestic wheat and flour prices.

1. Cointegration of price movements across regions of wheat prices

We will carry out the analysis of product price differentiation across 19 Pakistani regions (Lahore, Faisalabad, Rawalpindi, Multan, Gujranwala, Sahiwal, Sargoda, Sialkot, Bahawalpur, Gujrat, Kasur, Karachi, Hyderabad, Sukkur, Larkana, Mirpurkhas, Nawabshah, Peshawar, Bannu, and Mingora). Interregional price dispersion expressed as the coefficient of variation of average monthly wholesale wheat prices corrected for CPI inflation (with the 2005 price as the base) from 2008 – 2013 is presented in Figure A3.1. One can clearly see two distinct trends. These are, firstly, the precipitous drop of the price dispersion from July 2008 to May 2009 and then fluctuations with no clear trend.

Table A3.1 presents the correlation matrix of the average monthly wholesale wheat prices. The correlation coefficient among the prices in different geographical regions appear to be quite high which points to markets cointegration but does not constitute the convincing evidence of such due to common effects affecting all geographical markets simultaneously. The effect of inflation was partially eliminated in these time series because the current prices are corrected for the CPI inflation but other common factors remain, such as annual weather conditions.

One interesting observation stemming from this matrix is that there appear two groups of regions, each of which exhibits relatively high correlation coefficients within the groups but relatively low coefficients between the groups. The first group is centered at Lahore and includes Faisalabad, Rawalpindi, Multan, Gujranwala, Sahiwal, Sargoda, Sialkot, Bahawalpur, Gujrat, Kasur, Larkana, and Nawabshah. The other group is centered at Karachi and includes Hyderabad, Sukkur, Mirpurkhas, Peshawar, and Bannu. This preliminary observation will have an effect on the cointegration of the regional prices as will be seen below.

In order to make a more convincing analysis, we resort to the classical regression cointegration analysis ascertaining whether prices in different markets are related in a stable long-run equilibrium. To start with, we checked whether the price series (logarithms of the average monthly prices in constant Rs) are stationary with the Augmented Dickey-Fuller test. It came as no surprise that none of the regional price series are stationary with the zero lag. We have also tried the 11 lags to take into account seasonality, although the length of the time series is not long enough to give the 11-lag test sufficient statistical power. None of the regional price series are stationary with 11 lags as well. However, all price series are stationery in first differences, as indicated by the ADF test with zero lag (but none is stationery with 11 lags; the above caveat about the limited power of this test applies again). The next step of the analysis was to run a set regressions linking the price in region i with the price in Lahore (see Table A3.2).

The zero-lag ADF test splits all regions into cointegrated with the Lahore market (where the test statistics in the fifth column is statistically significant at least at the 10 percent level) and the non-cointegrated with the Lahore (otherwise). (The 11-lag ADF test statistics is insignificant for all but two regions although the short time period under consideration prevents us from putting too much significance to the 11-lag test).

We then investigate the cointegration relationships among the regions which do not show cointegration with the Lahore market (Table A3.3). Here, again, we find a significant cointegration relationships with the zero-lag ADF test and no cointegration with the 11-lag ADF test, except for one region but the 11-test lag has a weak statistical power due to the data limitations.

Overall, the data points to two cointegration clusters emerging: one centered at Lahore and the other – at Karachi. There is no cointegration relationship between the two clusters. Lahore and Karachi are the capitals of two main wheat-producing provinces, Punjab and Sindh, respectively. Therefore, we find wheat markets cointegrated within but not between provinces.

2. Wheat flour and Basmati rice prices

We continue the analysis with two other products – wheat flour and Basmati rice. It is carried out along the same lines as the analysis for wheat. In both cases, we use wholesale monthly prices, by region. The data are in Pak Rs and are available from 2008 to 2013. We eliminate the common cross-regional inflationary effect by deflating current prices with the CPI index, just like in the case of wheat. Similarly, we take logarithms. The 11-lag Dickey-Fuller test has low explanatory power due to a short time series. We rely on the zero-lag Dicker-Fuller test instead. In order to shorten the exposition, we do not describe in detail all steps of analysis which were undertaken, similar to the ones described above. We will highlight only on the most important results.

2.1. Wholesale wheat flour prices

The evolution of the interregional coefficient of variation is presented in Figure A3.2. After initial large fluctuations, the price variability stabilized in June 2009 and remained rather stable since.

Both the wheat flour and Basmati rice monthly prices are integrated to order one -- non-stationary in levels and stationary in differences. The cointegrating regression estimation results are presented in Tables A3.4 (wheat flour) and A3.5 (Basmati rice).

All but four regions appear to be cointegrated with Lahore. The nonintegrated regions include Hyderabad, Sukkur, Larkana, and Peshawar. We fit the cointegration relationships among the regions which do not show cointegration with Lahore taking Hyderabad as the reference region. The results presented in the same table show that these regions are cointegrated among themselves. Thus there appear two nonintegrated geographical macroregions, each of which consists of cointegrated regions.

2.2.Basmati rice prices

Here we extend this analysis to rice. Rice is a high value cash crop and also a major export item. Pakistan annually produces about 5.5 - 6 million tons and exports about 2.5 - 3 million tons which is about 9-10 percent of the world rice trade. There are two main varieties of rice produced – Basmati and IRRI. Basmati rice is consumed by more affluent consumers due to its higher prices. IRRI rice represents the IRRI 6 variety originally developed in Philippines. It is a coarse rice. Basmati rice is produced in Punjab only. IRRI rice is produced in both Punjab and Sindh provinces, but Sindh plays a vital role in the production of IRRI rice. The rice market in Pakistan is liberalized. The government does not carry out massive interventions.

The dynamics of the Basmati rice price variability is given on Figure A3.3. There is no clear trend of interregional price variation over time; however with significant fluctuations of the variation occurred.

Table A3.5 presents the cointegration estimation. Here, again, we observe two cointegration clusters: one centered at Lahore and the other – at Hyderabad. There is no cointegration relationship between the two clusters.

3. Cointegration of price movements of retail wheat flour prices between Lahore (Pakistan) and Jalalabad (Afganistan)

Chabot and Dorosh (2007) found cointegration between Lahore and Jalalabad for 2002-2005 monthly retail wheat prices. We have repeated this exercise for retail wheat flour prices and for a later time period – from 2008-2013 (monthly data). The estimated cointegrating relationship between retail wheat flour prices in Lahore and Jalalabad (the latter expressed in Pak Rs at the prevalent exchange rate) failed to yield a statistically significant regression coefficient and to reject the unit root hypothesis (see Table A3.6). Thus the cointegrating relationship between retail wheat flour prices on these two markets cannot be confirmed. A relationship estimated in price levels yielded similar results: no cointegration.

4. Analysis of market integration within value chains

Next, we carried out the analysis of market integration within two value chains – one for wheat and another for rice (Basmati and IRRI varieties separately). The prices used are the deflated average national prices. The structures of the value chains in question are:

- for wheat: (a) wholesale price of wheat - (b) wholesale price of wheat flour (average quality) - (c) retail price of wheat flour (average quality);
- for both Basmati and IRRI rice: (a) wholesale price - (b) retail level
-

The cointegration relationship in the wheat value chain is a two factor regression: retail wheat flour price as a function of the wholesale wheat price and wholesale wheat flour price. The Dickey-Fuller test is performed on the regression residual. It confirms cointegration within the wheat value chain, and the value chains for the both varieties of rice are also cointegrated (see Table A3.7).

5. Impact of government wheat release policy on wheat and flour price dynamics

One of the main declared goals of the Wheat Price Stabilization Scheme is maintaining wheat affordability and price stability. We will analyze the impact of one of the instruments of the program – the release of wheat – on the price dynamics. Net wheat releases (releases minus procurement) increase the availability of wheat and thus are supposed to dampen price fluctuations. We will consider two indicators of wheat releases – the gross release and the net release. It should be realized, however, that procurement is concentrated during the period of two to three harvesting months each year. The bulk of the procurement is carried out in just in the month of May. Therefore, procurement sets the stage of the stocks for the whole year while periodical monthly releases helps to dampen the price fluctuations during the year.

In order to quantify the impact of government wheat release policy on wheat and flour price dynamics, we apply the two-step error correction model of Engel and Granger (1987). The first step of the model investigates a long-term cointegrating relationship among the dependent variable and independent variables. Cointegration means that the dependent and all independent variables are integrated of the same order and the regression error is integrated of order one (i.e. stationary). The second regression of the models links the changes in the dependent variable with its own lagged changes as well as with (lagged) changes of independent variables and lagged error term from the step one regression. The step two regression describes the short-term effects of the independent variables on the dependent variable. In this framework, we will investigate the long- and short-term impacts of the monthly wheat release by the government on monthly prices.

We start with exploring the relationships between gross wheat release and wheat wholesale prices. The dependent variable is the monthly wholesale wheat price. The total monthly release in Punjab (in tons) and the monthly international price (U.S. Gulf fob wheat price converted into Pak Rs at the prevailing exchange rates) are the independent variables. As in the previous analysis, all variables are in logarithms. We explore four variants of the model. Each variant corresponds to a different price indicator for the dependent variable: (i) wholesale price in the Karachi region; (ii) wholesale price in the Lahore region; (iii) the national average price; and (iv) the average price in Punjab.

The fifth model deals with the impact of the release of wheat on the retail price of wheat flour. We take the Karachi retail price of wheat flour as the dependent variable. The cointegrating variables in this model include wholesale wheat price and wheat release.

All variables are integrated of degree one (stationary in differences). Thus the variables will be cointegrated if the error term of the first-step equation is stationary. The results of the first-step estimation of these five models are presented in Table A3.8.

Three conclusions stem from these regressions:

1) Wholesale prices of wheat in Lahore, Karachi, Punjab (average) and Pakistan (average) are cointegrated with the international price of wheat and release volume, as demonstrated with Models 1 – 4.

2) The long-term impact of release is small and positive. The numbers in the table are elasticities of the wholesale price with respect to release, that is, a one percent increase in release amount leads to 0.008 – 0.016 percent increase in the wholesale price. This is a negligibly small effect with the pro-cyclical direction.

3) the retail price of flour in Lahore is cointegrated with wholesale wheat price in Lahore and release (Model 5). However, the release variable is very small and counter-cyclical. A one percent increase in release amount leads to 0.013 percent decrease in the wholesale price.

The second-stage equation is given in Table A3.9. Models for the wholesale wheat prices show that the short-term effect of change in release quantity goes from nil (Model 1: the insignificant coefficient) to 0.11 percent as a result of a one percent increase in release amount. But even these small effects are pro-cyclical. In Model 5, the retail price of flour is unaffected by the changes in release (both coefficients at change in release are statistically insignificant).

The analysis with net release (release minus procurement) yields similar results (see Tables A3.10 and A3.11). The long-run elasticities of the price with respect to release for all models are either small and pro-cyclical or insignificant. The similar short-run elasticities are also either small and pro-cyclical or insignificant. Thus we again could not identify the stabilizing effect of the net release on prices.

The main conclusion of this section is that the models of the impact of release of wheat on the prices of wheat and wheat flour do not provide the evidence of a dampening effect of the release amount on wheat and flour prices.

6. Conclusions

1. The analysis of the spatial co-integration for three products (wheat; wheat flour (average quality); and rice - Basmati) at wholesale prices shows a geographically clustered cointegraiton. It appears that there are two price clusters - one around Lahore and one around Karachi/Hyderabad prices.

2. We did not find the evidence of cointegration between retail wheat flour prices in Lahore (Pakistan) and Jalalabad (Afganistan).

3. The analysis of market integration within value chains (wheat-wheat flour and rice) shows

that the markets are strongly cointegrated vertically. This is a somewhat expected result but it weaken the rationale and justification for government intervention on commodity markets.

4. Models of the impact of monthly release of wheat on the prices of wheat and wheat flour do not provide the evidence of a dampening effect of the release amount on wheat and flour prices.

Figures and Tables

Table A3.1: Correlation coefficients for wholesale monthly wheat prices from July 2008 to January 2013.

	LHR	FSL	RWP	MUL	GUJ	SWL	SRG	SLK	BWP	GJT	KAS	KAR	HYD	SUK	LRK	MPK	NWB	PES	BNU
LHR	1.0000																		
FSL	0.9156	1.0000																	
RWP	0.9490	0.9425	1.0000																
MUL	0.9075	0.9685	0.9500	1.0000															
GUJ	0.9258	0.9172	0.9249	0.9287	1.0000														
SWL	0.8866	0.9423	0.9216	0.9446	0.9288	1.0000													
SRG	0.9002	0.9487	0.9397	0.9630	0.9261	0.9489	1.0000												
SLK	0.9305	0.9555	0.9387	0.9397	0.9318	0.9536	0.9353	1.0000											
BWP	0.8817	0.9208	0.8974	0.9366	0.9002	0.8889	0.9039	0.8946	1.0000										
GJT	0.9224	0.9247	0.9295	0.9494	0.9529	0.9456	0.9369	0.9479	0.9336	1.0000									
KAS	0.9645	0.9153	0.9324	0.9096	0.9200	0.9071	0.8979	0.9393	0.8640	0.9228	1.0000								
KAR	0.6475	0.6810	0.7343	0.6956	0.5961	0.5854	0.6889	0.6362	0.7008	0.5943	0.6370	1.0000							
SUK	0.7509	0.8000	0.8349	0.8238	0.7155	0.7339	0.8051	0.7649	0.7971	0.7324	0.7530	0.9476	1.0000						
LRK	0.7784	0.8180	0.8398	0.8291	0.7427	0.7453	0.8155	0.7765	0.8102	0.7451	0.7844	0.9241	0.9666	1.0000					
MPK	0.6622	0.6375	0.7018	0.6337	0.5920	0.5751	0.6677	0.6224	0.7207	0.5974	0.6187	0.8941	0.8822	0.8800	1.0000				
PES	0.7773	0.8155	0.8486	0.8367	0.7500	0.7599	0.8262	0.7797	0.8031	0.7459	0.7851	0.9089	0.9731	0.9598	0.8769	1.0000			
BNU	0.6612	0.6632	0.7144	0.6768	0.6007	0.5860	0.6784	0.6284	0.7313	0.6221	0.6332	0.8866	0.9077	0.9016	0.9474	0.9107	1.0000		
QTT	0.5519	0.5909	0.6665	0.6040	0.5115	0.5117	0.6166	0.5261	0.5798	0.4988	0.5579	0.9175	0.9034	0.8834	0.8579	0.8922	0.8619	1.0000	
SUK	0.5877	0.6101	0.6655	0.6030	0.5178	0.4993	0.6069	0.5443	0.6367	0.5145	0.5758	0.9342	0.8940	0.8950	0.9124	0.8819	0.9065	0.9535	1.0000

Regional codes:

Code	LHR	FSL	RWP	MUL	GUJ	SWL	SRG	SLK	BWP	GJT
Region	Lahore	Faisalabad	Rawalpindi	Multan	Gujranwala	Sahiwal	Sargoda	Sialkot	Bahawalpur	Gujrat
Code	KAS	KAR	HYD	SUK	LRK	MPK	NWB	PES	BNU	MNG
Region	Kasur	Karachi	Hyderabad	Sukkur	Larkana	Mirpurkhas	Nawabshah	Peshawar	Bannu	Mingora

Table A3.2: Cointegration analysis of monthly wholesale wheat prices, 2008-13 in Pakistan

(Independent variable – price in Lahore)

Dependent variable: price in region	Cointegration coefficient	Standard error	Coefficient = 1[a]	ADF (zero lags)	ADF (11 lags)
Faisalabad	.9853896	.0594442	Yes	-3.818***	-1.509
Rawalpindi	.9911452	.0452189	Yes	-5.751***	-1.487
Multan	1.046188	.0665234	Yes	-4.361***	-1.012
Gujranwala	1.061229	.0595408	Yes	-5.032***	-1.676
Sahiwal	1.042057	.0746756	Yes	-4.758***	-1.684
Sargoda	1.023503	.0680192	Yes	-5.833***	-1.408
Sialkot	1.046939	.0566074	Yes	-3.628***	-1.621
Bahawalpur	1.031151	.0757742	Yes	-3.108**	-0.934
Gujrat	1.014658	.0583682	Yes	-4.068***	-1.625
Kasur	1.021964	.0384134	Yes	-5.412***	-1.914
Karachi	.8977678	.1451387	Yes	-2.221	-2.557
Hyderabad	1.176381	.1421107	Yes	-2.322	-2.963**
Sukkur	1.271137	.1408281	Yes	-2.369	-2.507
Larkana	1.274684	.1981543	Yes	-2.985**	-2.496
Mirpurkhas	1.259588	.1400595	Yes	-2.456	-2.314
Nawabshah	1.294038	.2016563	Yes	-2.949**	-2.568*
Peshawar	1.15746	.2402025	Yes	-1.875	-2.013
Bannu	1.352588	.255751	Yes	-2.200	-2.241

[a] *95% confidence interval includes 1.*

The number of asterisks shows the confidence levels at 1 (***), 5 (**), and 10 (*) percent.

Table A3.3: Cointegration analysis of monthly wholesale wheat prices, 2008-13 in Pakistan

(Independent variable – price in Karachi)

Dependent variable: price in region	Cointegration coefficient	Standard error	Coefficient = 1	ADF (zero lags)	ADF (11 lags)
Hyderabad	1.070627	.0495981	Yes	-4.186***	-0.469
Sukkur	1.088425	.0618251	Yes	-4.726***	-0.848
Mirpurkhas	1.062331	.0669484	Yes	-3.910***	-0.983
Peshawar	1.387628	.0826482	No	-3.576***	-2.013
Bannu	1.550634	.0813147	No	-4.151***	-3.376**

Table A3.4: Regional cointegration analysis of wholesale wheat flour prices, 2008-13

Dependent variable: price in region	Cointegration coefficient	Standard error	Coefficient = 1	ADF
(Independent variable – price in Lahore)				
Faisalabad	.7362154	.0441038	No	-3.547*
Rawalpindi	.9259045	.0338866	No	-4.872***
Multan	.8873139	.0332932	No	-4.197 ***
Sahiwal	.9409189	.0747821	Yes	-2.986**
Sargoda	1.05111	.0747318	Yes	-3.036**
Bahawalpur	.9588504	.0502775	Yes	-4.211***
Gujrat	.9542478	.055046	Yes	-3.060**
Karachi	.3694992	.0663555	No	-3.853***
Hyderabad	.484183	.0526266	No	-2.621*
Sukkur	.2658504	.0548985	No	-2.297
Larkana	.3101456	.0579048	No	-2.032
Mirpurkhas	.3089302	.054308	No	-5.393***
Peshawar	.3381812	.0522845	No	-2.282
Mingora	.223887	.0555273	No	-6.163***
(Independent variable – price in Hyderabad)				
Sukkur	.6498214	.0586218	No	-3.307**
Larkana	.6418443	.0760478	No	-2.904**
Peshawar	.5884214	.0793628	No	-3.209**

[a] *95% confidence interval includes 1.*

Table A3.5: Regional cointegration analysis of Basmati rice prices, 2008-13

Dependent variable: price in region	Cointegration coefficient	Standard error	Coefficient = 1	ADF
(Independent variable – price in Lahore)				
Rawalpindi	.6586133	.0452038	No	-3.278**
Gujranwala	.798341	.0896917	No	-2.044
Sahiwal	.9093617	.0580658	Yes	-2.973**
Sialkot	.6839871	.0894492	No	-1.927
Bahawalpur	.9399796	.0755649	Yes	-3.592**
Gujrat	1.193825	.0712861	Yes	-3.395**
Kasur	1.000233	.0386105	Yes	-3.621***
Karachi	.6169912	.06805	No	-2.620*
Hyderabad	.6316215	.0527811	No	-2.305
Sukkur	1.024609	.0510238	Yes	-3.356**
Larkana	.5523186	.0617516	No	-2.620*
Mirpurkhas	.2808067	.0849161	No	-2.312
Peshawar	.4757974	.0742856	No	-3.064**
Bannu	.3249624	.0572198	No	-3.009**
(Independent variable – price in Hyderabad)				
Gujranwala	1.217158	.0936265	Yes	-4.003***
Sialkot	1.133198	.0809843	Yes	-3.767***
Mirpurkhas	.5124937	.1046821	No	-2.259

Table A3.6: Cointegrating relationship between Lahore and Jalalabad retail wheat flour prices, 2008-2013

Dependent variable	Cointegration coefficient	Standard error	Coefficient = 1	ADF
(Independent variable – log price in Lahore)				
Log price in Jalalabad	-.1443622	.1753078	No	-1.655

Table A3.7: Value chain cointegration analysis of monthly wholesale wheat and rice prices, 2008-13

Independent variable	Cointegration coefficient	Standard error	ADF
Value chain: wheat wholesale - flour wholesale - flour retail			
(Dependent variable – retail wheat flour price)			
Wholesale wheat price	.6586133	.0452038	
Wholesale wheat flour price	.798341	.0896917	
ADF for regression residual			-4.160***
Rice value chain			
(Dependent variable – retail rice price)			
Basmati wholesale	. 5976157	.0845609	-2.924**
IRRI wholesale	1.09025	.0432648	-4.327***

Table A3.8: Step one (long-term) cointegrating relationships, 2008-2013

	Model 1	Model 2	Model 3	Model 4	Model 5
Dependent variable	Karachi wholesale wheat price	Lahore wholesale wheat price	Ave. national wholesale wheat price	Ave. Punjab wholesale wheat price	Lahore retail wheat flour price
International price	.2227463***	.2136081***	.1585965***	. 203685***	
Wheat wholesale price in Lahore					1.211722***
Release in Punjab	.00809418*	.0148449** (lagged: t-1)	.0160066***	.0148334*** (t-1)	-.013727***
Adj. R^2	0.4227	0.3115	0.3892	0.3029	0.8441
ADF test	-2.955**	-3.256**	-2.966**	-2.933**	-3.648***

Table A3.9: Step two (short-term) relationships, 2008-2013

	Model 1	Model 2	Model 3	Model 4	Model 5
Dependent variable	Change in Karachi wholesale wheat price	Change in Lahore wholesale wheat price	Change in ave. national wholesale wheat price	Change in ave. Punjab wholesale wheat price	Lahore retail wheat flour price
Lagged change in wholesale price (autoregressive term)	.3224684**	-.0337585	.0471575	-.0168542	
Change in International price	-.1566746*	-.195325***	-.145594**	-.1574683**	
Change in wheat wholesale price in Lahore					.6265669***
Change in release in Punjab	-.0001241	.0109051***	.0078326***	.0096392***	-.0051081
Lagged change in release in Punjab	.0005686	.0040527	.0048131*	.0058951**	.0040188
Adj. R^2	0.2580	0.3161	0.2195	0.2500	0.2819

Table A3.10: Step one (long-term) cointegrating relationship of wholesale wheat price/Lahore retail wheat flour price and net release of wheat, 2008-2013

	Model 1	Model 2	Model 3	Model 4	Model 5
Dependent variable	Karachi wholesale wheat price	Lahore wholesale wheat price	Ave. national wholesale wheat price	Ave. Punjab wholesale wheat price	Lahore retail wheat flour price
International price	.2069925***	.179211***	.1389242***	.1629916***	
Wheat wholesale price in Lahore					1.135894***
Net release (release minus procurement)	.0012881	.0028683 (lagged: t-1)	.002606*** (t-1)	.0025241** (t-1)	-.0016727
Adj. R^2	0.4308	0.3145	0.4244	0.2686	0.8079
ADF test	-2.908**	-2.788**	-2.706**	-2.417	-3.608*

Table A3.11: Step two (short-term) relationship of wholesale wheat price/Lahore retail wheat flour price and net release of wheat, 2008-2013

	Model 1	Model 2	Model 3	Model 4	Model 5
Dependent variable	Change in Karachi wholesale wheat price	Change in Lahore wholesale wheat price	Change in ave. national wholesale wheat price	Change in ave. Punjab wholesale wheat price	Lahore retail wheat flour price
Lagged change in wholesale price (autoregressive term)	.2919868**	.0376609	.2096989	.1877965	
Change in International price	-.1294177**	-.094484	-.0901199*	-.1038552*	
Change in wheat wholesale price in Lahore					.1590949
Change in release	.0000598	.0008806	.001446***	.0016989***	-.0002713
Lagged change in release	.0002298	.0012715**	.000315	.0001879	-.0017994**
Adj. R^2	0.2238	0.0982	0.2372	0.2329	0.3105

Figure A3.1: Pakistan wholesale wheat prices: interregional coefficient of variation

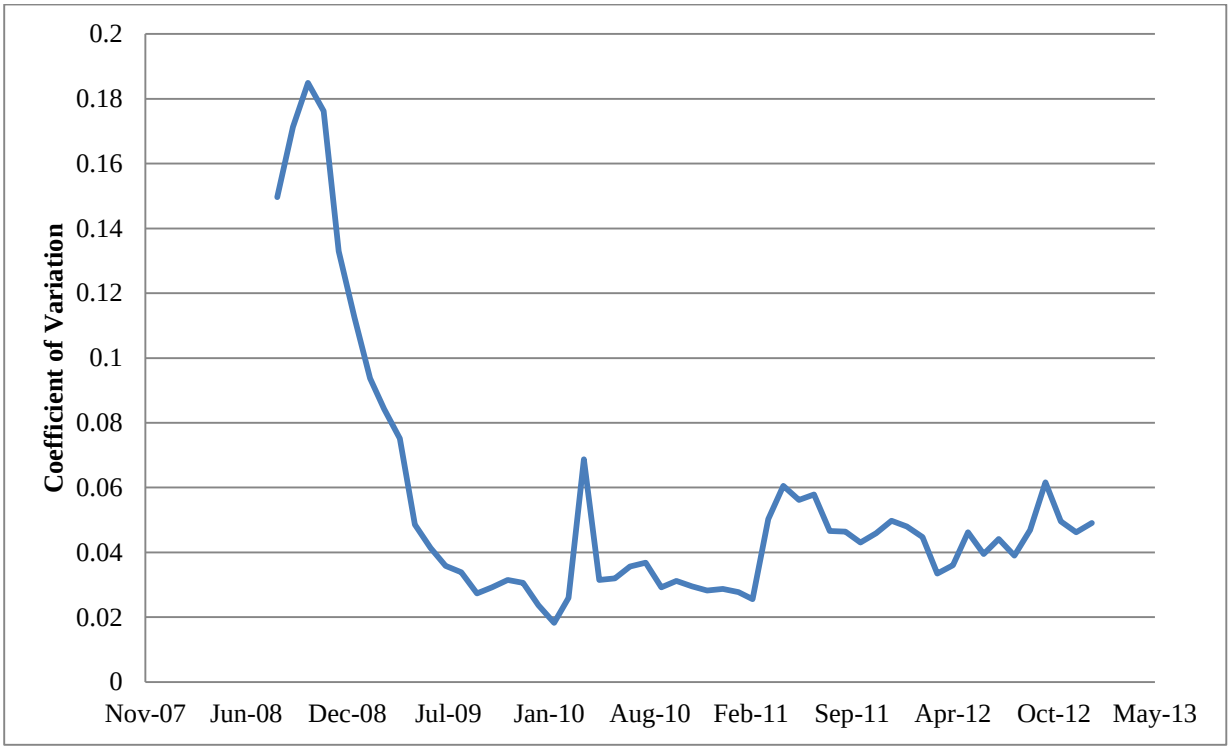


Figure A3.2: Pakistan wholesale wheat flour prices: interregional coefficient of variation

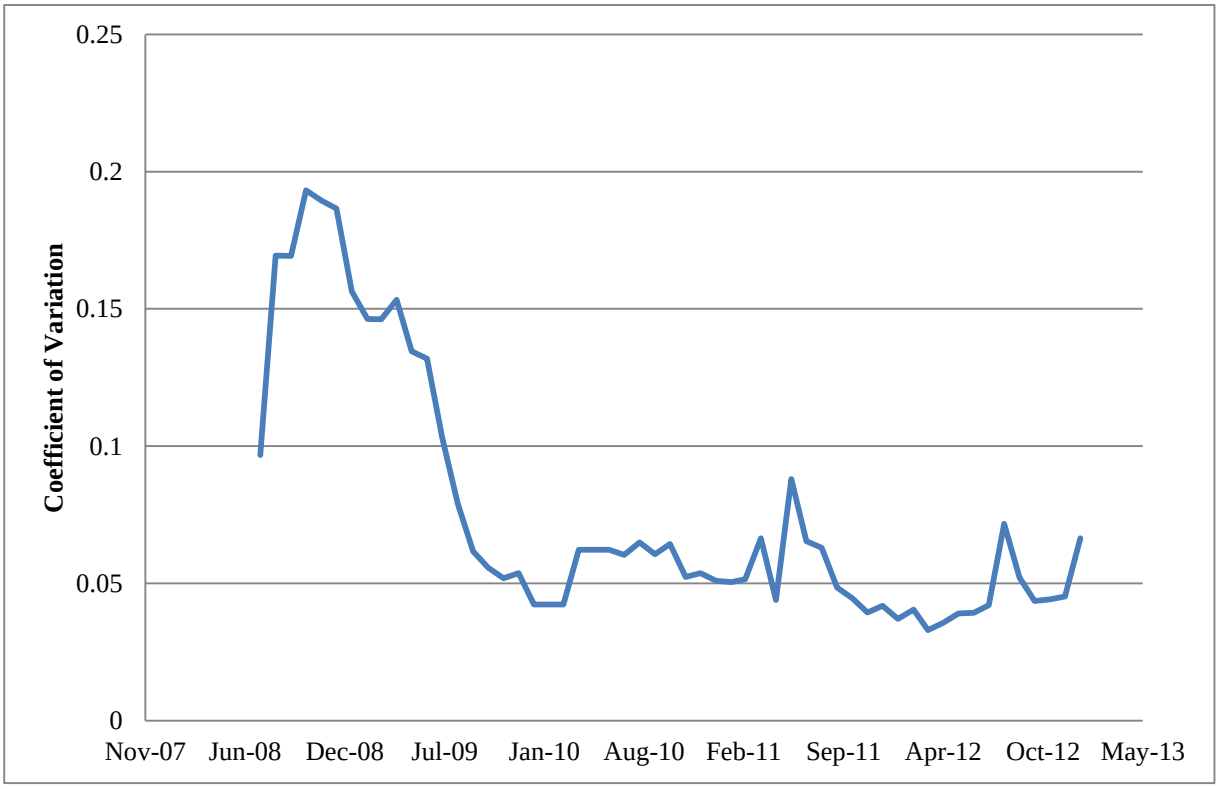


Figure A3.3: Pakistan wholesale rice (Basmati) prices: interregional coefficient of variation