Agricultural Water Management xxx (2013) xxx–xxx

Contents lists available at ScienceDirect

Agricultural Water Management

journal homepage: www.elsevier.com/locate/agwat

Price leadership and information transmission in Australian water allocation markets☆

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Water markets
Price leadership
Australia
Murray–Darling Basin

ABSTRACT

This paper explores relationships in price and volumes across two trading zones of the water allocation market in the Goulburn-Murray Irrigation District in Northern Victoria. Previous papers have explored the reasons for price variations across trading zones within this region, our focus is to add to this literature by analysing how information is incorporated into market prices across different zones that can contribute to the presence of price leadership. Market prices reflect the incorporation of new information and evidence from financial markets suggests that this process leads to a pervasive lead–lag relationship across alternative markets offering similar products. As a result, markets with leading prices are thought to incorporate new information first. We examine if this lead–lag relationship exists in the far less liquid water market. Our analysis shows that the most actively traded of the two trading zones (the Greater Goulburn trading zone) plays a key role in price leadership. We postulate that the nature of production in the different zones contributes to this lead–lag relationship in prices because crops tend to be zone specific and each crop has different water requirements both within and between seasons. This drives the most active trading zone to play a greater role in the price discovery process.

1. Introduction

Water policy in Australia's irrigation sector has undergone fundamental changes over the last thirty years. These changes began in the late 1980s when several state governments repealed legislation that tied water rights to land ownership laying the foundation for water to be traded as a separate commodity. These policy shifts were followed by more coordinated efforts to promote liberalisation of water regulation with the Council of Australian Governments (COAG) in 1994 agreeing to reform water sector administration across the country to create greater water use efficiency. As part of this agreement state governments were given financial incentives to implement a policy agenda promoting property rights reform to facilitate market-based approaches to water allocation (Brennan, 2006). Ten years later, in 2004, COAG reforms were followed by the National Water Initiative which sought to further expand water trading across regions and states (Heaney et al., 2006; Brennan, 2006). These reforms reflected the explicit recognition by Australian governments that the centralised allocation and pricing regimes adopted in the twentieth century were no longer suited to the, now mature, water sector. Moreover, reforms recognised the introduction of trading could lead to better outcomes for the environment in highly stressed riverine environments because greater irrigation efficiency created the potential for larger volumes of surplus water that could be utilised to improve in-stream flows.

Since the introduction of trading, a number of studies have analysed the impact of historical path dependency on outcomes in water markets (Brennan, 2006, 2008; Harris, 2011). Despite trading restrictions brought about by path dependence, existing water markets have been found to produce significant gains (Brennan, 2006; Brooks and Harris, 2008; National Water Commission, 2012). Studies have also examined the operation of water markets, particularly Watermove, and how farmers have responded to market incentives, policy changes, and fluctuating climatic conditions (for example, Brooks and Harris, 2008; Wheeler et al., 2010). Generally, there are two main types of rights: entitlements and allocations. Entitlements are a perpetual share of the volume of the specific waterway from which a farmer is supplied. Allocations are the volume of water an entitlement holder can access in a given season. Seasonal allocations are variable within and between seasons as information on available supplies, in-stream flow commitments, and rainfall change over time. During extreme drought these allocations can drop to very low levels for example, in 2007/08 users in the Goulburn regulated system were assigned 35% of

☆ We thank participants at the Wessex Institute of Technology University of South Australia 4th Conference on Sustainable Irrigation and Drainage: Management, technologies, and policy systems for feedback on an earlier draft of this paper.

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http://dx.doi.org/10.1016/j.agwat.2013.10.010

the total seasonal allocations available (http://www.nvrm.net.au/allocations/history/pages/allocations20071115.aspx).

Irrigators can trade both their entitlement and their seasonal allocation. By selling an entitlement the irrigator is transferring in perpetuity some or all of their rights to a share of the waterway to another user. If an irrigator sells their water allocation however, they are only transferring the use of that volume for the duration of the particular season in which the sale occurs. In the next season the allocation reverts back to the original owner. For example, if A has 100 megalitres (ML) of water allocation in season one and sells 50 ML of this to B, A can only utilise 50 ML in that season. In season two the 50 ML A sold to B in period one is automatically returned to A and, assuming seasonal allocations for that district remain the same, A can access the full volume of 100 ML (if no entitlement water has been sold).

The overwhelming majority of the trade is in seasonal water allocations with the bulk of the water allocation trade takes place in the Northern Victoria Regulated region and is concentrated in three trading zones. Thus, the analysis of the operation of markets for irrigation water has focused on either all three of these trading zones (see Brooks and Harris, 2008) or only the most active trading zone, the Greater Goulburn (see Wheeler et al., 2008). However, one aspect of trading that has, to date, not been examined is the extent to which the actively traded zones provide a more general leadership role in the setting of prices. Bjornlund (2003) identifies that the market exchanges provide information in price setting to both traders and brokers that conduct private trades. Brennan (2006) also shows the spatial relationships between prices across the trading zones. The focus of this paper adds to this literature by analysing what role, if any, price leadership plays across trading zones based on market activity and trading volume. The primary focus is to examine whether the price leadership findings for financial markets extend across to water markets. In previous research Brooks et al. (2009, 2013) have found that market depth and price clustering characteristics common in financial markets are also present in newly developed water markets. Thus, we explore whether a similar finding applies to price leadership characteristics. Our results indicate that the most active trading zone takes on a price leadership role that is consistent with the financial literature (described in Section 2). This implies that water markets are developing in a similar fashion to more liquid and efficient financial markets.

The rest of the paper is set out as follows: Section 2 provides an overview of the relevant financial literature that examines the role of price leadership in different markets. Section 3 outlines the nature of the specific water market, Watermove, being examined as well as the constraints on trade between trading zones. Section 4 discusses the data and results of the econometric analysis with respect to price leadership. Section 5 offers some concluding remarks.

2. Price leadership

Financial markets are a means to aggregate information that is widespread in the economy with price discovery being an essential function of these markets (Green et al., 2008; Menkhoff and Schmeling, 2010). In a frictionless market commodity prices for perfect substitutes would adjust simultaneously to new information reflecting its influence on asset values (Easley and O'Hara, 1987; Fleming et al., 1996). However, in the real world, friction exists and therefore, some prices adjust more slowly than others. The market that dominates the price discovery process will be the first in which prices reflect new information creating a lead–lag relationship between alternative markets for similar products. The rapidity with which new information is incorporated into prices is one way to determine the extent of a market's efficiency. Price leadership has been examined extensively in empirical finance with most studies focusing on comparisons between stock, futures, and option markets (for example, Booth et al., 1999; Fleming et al., 1996; Hsieh, 2004; Menkhoff and Schmeling, 2010; Roope and Zurbruegg, 2002; Chordia and Swaminathan, 2000; Tse, 1998, 1999).

Generally markets with greater liquidity, lower transaction costs, and fewer regulatory restrictions are likely to play a more important role in price discovery (Chordia and Swaminathan, 2000; Tse, 1999). Empirical studies have highlighted the importance of these factors on the presence of price leadership in financial markets. For example, Roope and Zurbruegg (2002) compare the information efficiencies between the Singapore Exchange and the Taiwan Futures Exchange by examining the Taiwan Index Futures listed on both markets. Their findings indicate that prices in the Singaporean market are likely to reflect new information first creating a lead–lag relationship in prices between these two markets. Tse (1999) compared the Dow Jones Industrial Average (DJIA) with the newly created Chicago Board of Trade with the results showing that the information share attributed to the futures market is 88.3% implying the DJIA dominates the price discovery process.

Many of these studies also indicate that market depth is a key factor in determining which market takes on a price leadership role. For instance, in the context of price discovery in foreign exchange markets Menkhoff and Schmeling (2010) explore which traders convey the most information to market prices. They find that trader size is one of the factors that impacts information flow and large traders provide more information. At an aggregate market level the relationship has been explored across futures and spot markets. In a follow up study Hsieh (2004) shows that reforms to reduce transaction costs in Taiwan increased price discovery in that market. This study also found a positive link between volume and information efficiency suggesting larger trading volumes can lead to better price discovery and thus increased volumes have reduced the information advantage of the Singapore market. In the context of stock markets Chordia and Swaminathan (2000) find that the returns of high volume stocks lead the returns of low volume stocks, a finding they attribute to informational advantages derived in part from trading volume.

The major difference between financial markets and water markets is that the products on the former are sold more frequently and in greater quantities compared with the latter. Water markets have a seasonal component because irrigation is a seasonal activity where different crops have diverse watering needs. There is also the potential for greater informational uncertainty in water markets because seasonal allocations and climate information is revealed only over the length of a season (Brennan, 2006). Further, there is potentially greater transaction costs in water markets as the result of regulatory restrictions brought about by hydrological and infrastructure constraints (detailed in Section 3). Rules limiting trades between high and low salinity impact zones, including a non-constant salinity levy also impede efficiency gains in the short-run (Pakula, 2004). The effect of the levy is to distort trade by increasing water prices in higher impact zones while decreasing prices in lower impact zones (Pakula, 2004). In light of these information and trading constraints it would be expected that, although water markets are less liquid than financial markets, they may reflect the price lead–lag relationships found in financial markets where one trading zone incorporates new information more quickly than others. In turn, this would indicate that some trading zones are more efficient than others.

3. Watermove

The removal of the nexus between water use and land ownership and the broader policy changes that followed led to the

Please cite this article in press as: Brooks, R., Harris, E., Price leadership and information transmission in Australian water allocation markets. Agric. Water Manage. (2013), http://dx.doi.org/10.1016/j.agwat.2013.10.010