Ecological Economics 146 (2018) 560–573

Contents lists available at ScienceDirect

Ecological Economics

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

Analysis

Private Transaction Costs of Water Trade in the Murray–Darling Basin☆

Adam Loch*, Sarah Ann Wheeler, Claire Settre

Centre for Global Food and Resources, Faculty of the Professions, The University of Adelaide, South Australia, Australia

ARTICLE INFO

Keywords:
Water trade
Time-series
Empirical analysis
Australia

ABSTRACT

High transaction costs can prevent the efficient allocation of resources towards socially-desirable outcomes. Water is a classic example of a resource with private and public socially-desirable benefits, which depend on its efficient allocation. Public and private institutions thus fulfil an important function by seeking to lower transaction costs in water markets. Where transaction costs are reduced, those same institutions may benefit from positive economic outcomes. However, in spite of their importance for policy performance evaluation, very few studies have investigated the impacts of transaction costs over time on the success or failure of public policy implementation and compliance. This study identifies important transaction costs and their rate of change in the world's leading water market: the southern Murray–Darling Basin in Australia. It was found that some progress towards lowering transaction costs in water markets has been achieved, particularly in respect to water allocation (temporary) transfers. However, some water entitlement (permanent) transaction costs have increased in the time-period, which may be justifiable given the inherent complexities associated with individual entitlement transfer assessments. Overall, the analysis suggests that institutional investment in water markets have improved irrigator private gains from trade.

1. Introduction

Transaction costs are an important and often overlooked component of the costs and benefits of establishing and maintaining water markets and market-based instruments (Productivity Commission, 2010). Such costs may prevent the desirable allocation of resources and thus, if possible, we should identify feasible ways to decrease the costs of transacting between market agents (Coase, 1960). The fundamental concept of transaction costs is "that they consist of the costs of arranging a contract ex ante, and then monitoring and enforcing it ex post; as opposed to production costs which are the costs of executing the contract" (Mathews, 1986, pg. 906). Prior to arranging a contract, private transaction costs may also include time invested in searching for appropriate partners with whom to contract (McCann et al., 2005); although broadly these might all be information costs (Dahlman, 1979). These costs consume resources that could be applied elsewhere, and may impede effective and efficient trade under poor-performing institutional arrangements and rules (Allen Consulting Group, 2006). Yet, in spite of their importance for performance assessment, very few studies have investigated the impacts of transaction costs on the success or failure of public policy implementation and compliance (Njiraini et al., 2017). Despite a long history of transaction cost studies that can be traced back to Knight (1921) and Commons (1931), measurement remains a particular and persistent challenge for transaction cost researchers (Wang, 2003).

A good example of price signals via market-based instruments and incentives can be found in the Australian water reform example which involves polluting behaviour deterrents, shared environmental rights, and welfare savings (Krutilla and Alexeev, 2014). The core of these reforms involve: a federal government Cap (limit) on further water extractions; unbundling land and water entitlements in anticipation of market-based transfers; the creation of the Murray–Darling Basin Authority (MDBA) and National Water Commission; ~AU$9billion investment in on- and off-farm water use infrastructure and ~AU$3billion investment in buying back water entitlements from willing irrigators to recover water resources for environmental use; and the *Water Act* (2007) which empowers a Basin-wide management plan incorporating sustainable diversion limits for water and agreements on economic, social and environmental water uses (Wheeler et al., 2014b).

The *Water Act* (Schedule 3, Clause 3(b)) also enshrines earlier

☆ Acknowledgements: Funding for this project is provided under Australian Research Council Discovery [DP140103946], DECRA Fellowship [DE150100328] and Future Fellowship [FF140100773] programs. The assistance and resources of Goulburn-Murray Water, the Victorian Water Register, the New South Wales Water Register, the South Australian Department of Environment, Water and Natural Resources and the Murray–Darling Basin Authority is gratefully acknowledged. We also thank the Editor and reviewers for helpful feedback and suggested improvements to the original manuscript.

* Corresponding author.
E-mail address: adam.loch@adelaide.edu.au (A. Loch).

https://doi.org/10.1016/j.ecolecon.2017.12.004
Received 8 May 2017; Received in revised form 17 October 2017; Accepted 1 December 2017
Available online 15 December 2017
0921-8009/

objectives of the *National Water Initiative* (COAG, 2004, Clause 58, ii.), which explicitly states Australian water markets should be designed to minimize transaction costs through good information flows together with harmonized registration, regulatory and other arrangements across jurisdictions. These objectives have led to new water market (ACCC, 2010) and trade rules aimed at reducing trade barriers and improving transparency (see Schedule D of the *Murray–Darling Basin (MDB) Agreement* (2014), which also forms part of the *Water Act*). Consistent with the view that reduced water trade transaction costs may result in gains from trade for irrigators and positive externalities for rural communities, the MDBA has also included transaction cost measures into their evaluation of Basin Plan policy effects (MDBA, 2014). These gains may manifest from trade for all water users, or more productive and resilient rural communities linked to positive policy effects. How the MDBA will measure and assess these different gains is less clear; although measures of transaction cost magnitude and direction over time could be helpful. Locating and collecting empirical transaction cost data may enable the evaluation of the effect of these policies. Thus, an empirical analysis of private water trade transaction costs in the world's leading water market (the MDB) could provide significant value to policy-makers, water managers and irrigators alike.

2. Background and Theory

The MDB includes irrigation districts that together represent 65% of Australia's irrigated land (MDBA, 2014). Crops range from annual broadacre (e.g. cotton, rice, pasture) to perennial types (e.g. winegrapes, citrus and nuts). Water resources that support these crops are shared between five states and territories, and in the south considerable infrastructure has been constructed to store, deliver and monitor those shared resources (Wheeler et al., 2014a).

2.1. Trade Arrangements

Shared infrastructure across the southern MDB states (i.e. New South Wales [NSW], Victoria [VIC] and South Australia [SA]) and a hydrologically-linked water delivery system has enabled once disconnected irrigation schemes to link and trade water rights. Tradable rights include: i) short-term or temporary water transfers (water allocation trade) that are already allocated and available for immediate use; and ii) permanent transfers (water entitlement trade) which provide on-going property rights to access either a proportion or fixed quantity of available water at a given source (Wheeler et al., 2017).

Initial intra-scheme trade (e.g. between irrigators in one irrigation scheme) which began in the 1980s, expanded to inter-scheme and even inter-state trade using exchange rates from the 1990s onwards (Etchells et al., 2004). Exchange rates create equivalence between water entitlement rights with different characteristics (e.g. location of use, extraction rates, etc.) to reduce the total time invested in assessing trades. State governments have also created and applied fees and charges to enable the definition and granting of tradable water rights, water accounting frameworks, trade registries and assessment, and enforcement of disputes. Below the state frameworks, many individual irrigation infrastructure operators (IIOs) have also developed water exchange platforms that can facilitate relatively easy internal water assessments and transfers, sometimes at zero-cost. Finally, there are water brokers (e.g. Waterfind) and other trade facilitators (e.g. solicitors) operating at the local, state and national levels who facilitate transfers on behalf of their clients for a fee.

The above arrangements highlight the range of water trade transaction costs in the MDB. Beyond the price or opportunity cost of the water allocation or entitlement asset, transaction costs include: i) time invested in monitoring market activity and identifying buyers/sellers; ii) negotiating the terms and conditions of trade; iii) monitoring and mitigating third-party effects; iv) contracting or conveyance to secure the trade; v) possible dispute resolution where contract terms are breached; and vi) barriers to trade resulting from restrictions or quotas on the total movement of water out of a district to avoid stranded asset issues,[1] or delivery constraints that limit transfers up or downstream (Rosegrant and Binswanger, 1994)—either of which may increase time spent checking the feasibility of trade opportunities. Indirect charges such as stamp duties or termination fees associated with permanent transfers of water entitlements may also reduce the efficiency of resource reallocation at the margin, resulting in transaction costs. Finally, other transaction costs arise from the complex nature of water goods (e.g. non-excludable, rivalrous, common good characteristics, third-party impacts (Howe et al., 1986)), which often dictate the need to carefully assess transfers between IIOs or across state boundaries. These characteristics may also make it challenging to measure transaction costs in practice.

2.2. Private Transaction Cost Theory

Water policy outcomes can be impacted by transaction costs, and how they relate to and influence the cost-effectiveness of first-order policy measures (Garrick and Aylward, 2012). For water transfer policies specifically (second-order), transaction costs may effect market performance through impacts on the initial allocation of resources (Dahlman, 1979) and the profitability of irrigators (Pujol et al., 2006). Putting the initial allocation of resources aside—although it is clearly important (Bromley, 1990)—differences caused by varying degrees of market transaction cost effects on the gains from trade between two representative irrigators is illustrated in Fig. 1.

Irrigator profitability from water market use will depend on the amount and structure of market costs, which may be differentiated by irrigator size, location and water use. If the initial allocation of water is different (e.g. q^e), then trade may offer mutual benefit. For example, if irrigator two buys water from irrigator one the gains from trade will be *ade*. Following Pujol et al. (2006), the impact of transaction costs may be evidenced by water allocation shifts from D^1 to D^1 + TC1 if transaction costs affect the seller, and from D^2 to D^2-TC1 if they affect the buyer. Taking transaction costs into account alters the optimal water allocation point (*a*) to *b*, *c* or *a′* where transaction costs affect the seller, buyer or both respectively. Furthermore, respective gains from trade will be the areas *cde′*, *bd′e* or *a′d′e′*.

While the structure (e.g. fixed or proportional) and distribution of transaction costs affect the cost of trade in different ways, so too can the level of market transaction costs. Where transaction costs can be reduced, gains from trade improve (as may irrigator profitability). Reducing total market transaction costs results in smaller water allocation shifts from D^1 to D^1 + TC2 and from D^2 to D^2-TC2 for each irrigator. This increases the gains from trade to *CdE*, *Bde* and *ADE* respectively. Therefore, if a lowering of transaction costs is identified in this study, it can be argued that positive socio-economic outcomes for irrigators are being derived.

2.3. Previous Literature

In Australia, the *National Water Initiative* requirements and *Water Act* trading rule changes sought to achieve compatible water trade registration and accounting arrangements, as well as reduced barriers to trade and improved transparency. Overall, their aims were to lower water trading transaction costs and increase the welfare of irrigators and irrigation-dependent rural communities. However, without the capacity to measure and compare transaction costs, the ability to evaluate the effects of these new arrangements is limited. Quantitative measurement of the magnitude and direction of transaction costs

[1] Stranded assets occur where the volume of water delivered through an IIO is reduced by transfers out of the scheme, resulting in insufficient remaining water demand to economically sustain/cover system operation costs.