Chapter 6

Conclusion

This dissertation examines the price linkage between stock index futures and their underlying shares and the price and liquidity impact of large trades in interest rate and equity index futures markets. The first of three studies provides the first evidence from the Australian index futures market of the value of the debt tax shield, cash dividends and imputation tax credits flowing from the underlying stocks after significant changes were made to the income tax regime including a reduction in capital gains tax from July 1999 and the introduction of rebates for unused franking credits from July 2000. Previous research by Cannavan, Finn and Gray (2004) inferring the value of the imputation tax credits from the prices of ISFs and LEPOs contracts is extended to index futures contracts written over a broad-based market portfolio that is more directly relevant to index fund managers. The second study in this dissertation complements previous research relating to price discovery in index futures markets (such as Hodgson, Masih and Masih, 2006) by providing parallel evidence of the source of information arrival in the cash market. Specific risks and transaction costs faced by arbitrageurs acting to exploit price discrepancies between the spot and futures markets are incorporated in the analysis, to determine which risks serve to curtail the supply of arbitrage services further out from maturity and control for intraday variations in transaction costs.

The third study in this dissertation investigates the impact of asymmetric information as measured by trade size in futures markets, which is likely to be fundamentally different to information asymmetry in equity markets analysed in prior research. Owing to differential transaction costs and expected profits, the futures market is likely to be the main source of market-wide information, while the cash market is likely to be the main source of firm-specific information (Chan, 1992). The market impact and speed of adjustment around large trades are assessed to determine whether liquidity providers make the same strategic choices in futures markets to those Easley and O’Hara (1987) and Mann and Ramanlal (1996) among others show they make in equity markets. The study expands upon previous work by Berkman, Brailsford and Frino (2005) by examining the market impact of large trades for a broader range of financial futures contracts that differ with respect to their risk profiles and baseline liquidity levels.
The observed basis of Australian stock index futures is used to infer the values of the debt tax shield, accumulated cash dividends and franking credits for the underlying stocks over the remaining life of the futures contract. If all investors were Australian taxpaying individuals who faced the same tax rate on interest, dividends and capital gains and could utilise the imputation credits, index futures prices would be expected to reflect the full cost of financing the underlying stocks and the gross dividends. Instead, it is evident that the cost of financing the set of shares of the underlying index provides a mild tax shield, the accumulated cash dividends are incompletely valued and the franking credits are worth at least fifty percent of their face value relative to futures payoffs. These findings are consistent with the harsher tax treatment of interest and dividend income relative to capital gains on stocks and dividend imputation tax credits that are partially valued by the marginal investor. In the Australian market, the timing option held by stockholders to defer capital gains and realise capital losses possibly accentuates the reduction in the effective financing cost brought about by the tax deductibility of interest on loans. From the practical standpoint of valuing SFE SPI 200™ futures, the valuation method needs to account for the taxation treatment of the financing charge and dividend flow from the underlying index reflected in market prices.

The values of the accumulated cash dividends and franking credits implied by index futures prices are very close to the ex-dividend date cash drop-off ratio and franking credit drop-off ratio respectively estimated by Beggs and Skeels (2006) for the Australian share market. The similarity with the ex-dividend behaviour of share prices confirms: (i) that marginal investors in the form of arbitrageurs do not trade up to the theoretical value of gross dividends; and (ii) that franking credits are unambiguously valuable to marginal investors after recent tax regime changes including a reduction in the capital gains tax rate and the establishment of tax rebates for unused franking credits.

A mispricing series using five-minute contemporaneous observations from the Australian S&P/ASX 200 spot index and SFE SPI 200™ futures market over a period of four years is constructed and analysed, using a time series and regression based approach similar to Brailsford and Hodgson (1997). The tax-adjusted cost-of-carry model, which accounts for the discrete and seasonal dividend payments of the underlying stocks, as well as the different taxation treatment of the financing charge and dividend flow relative to capital gains on stocks and the pricing of the imputation tax
credits on franked dividends, is used as the valuation method for the futures contract. The results indicate that the mean pricing error is close to zero and noticeably less volatile than in other studies, confirming that the tax-adjusted market valuation model produces a relatively unbiased estimate for the futures price. Slightly more than half of the observations are negatively mispriced, consistent with the higher transaction costs involved in short selling stock.

Time series analysis confirms that the raw mispricing exhibits a high degree of autocorrelation and predictability. Mispricing based on the tax-adjusted series is significantly higher on Monday and significantly lower on Wednesday. After filtering out the dynamic and static time series components, a number of explanatory variables are significantly associated with the absolute residual mispricing. Overnight public information arrival modelled as volatility from the United States stock market and market-wide information arrival modelled as unexpected trading volume and the volatility of SFE SPI 200™ futures are confirmed to have a positive and significant impact on the mispricing spread. In addition, the negative impact of unexpected trading volume in the underlying stocks is consistent with the presence of index arbitrageurs acting to narrow price disparities relative to the futures market. In support of the differential information hypothesis, this finding highlights that the adjustment of the underlying stock market to macroeconomic information is facilitated by price discovery in the futures market.

Indicated by its impact on the mispricing spread, ex-ante interest rate volatility is the primary source of risk faced by arbitrageurs when they act upon deviations from theoretical pricing levels further out from maturity. From the standpoint of the central bank therefore, the efficiency of the arbitrage mechanism is improved by smoothing short-term interest rates. In contrast, the impact on the near contract of dividend yield uncertainty based on the dispersion of analysts’ forecasts for index constituent stocks is statistically insignificant and appears to be trivial. The implicit transaction cost represented in bid-ask spreads involved in opening up stock and futures positions has the most important influence on the width of the arbitrage bounds for index futures. Arbitrageurs require greater compensation to step into the market when bid-ask spreads for the index constituents are large. This follows because bid-ask spreads for the underlying stocks are wider and more variable than in the futures market. There is little evidence that the pricing of the near contract deviates from its theoretical level more frequently due to the cost of borrowing stocks. From the standpoint of securities
exchanges and regulators therefore, the efficiency of the arbitrage mechanism is improved by increasing the level of liquidity in the stock market; thereby strengthening the most vulnerable point relied upon to maintain the price linkage between stock index futures and their underlying shares.

Futures markets are found to respond to the information content of large individual trades. Prices increase after block purchases and decrease after block sales without recovering, leaving permanent price effects that are positively related to the size of the block. The permanent price effects of block sales match the permanent price effects of block purchases, implying there are as many informed sellers as informed buyers in futures markets. The signed price change continues over several quote revisions before prices stabilise roughly one minute after the block strikes the order book. So neither the compensation hypothesis nor the orderly market hypothesis appears to be supported in futures markets; liquidity providers do not receive price concessions on post-block trades and there is little incentive for them to restrict the size of sequential price changes. Furthermore, there are insufficient price reversals following block trades to compensate liquidity providers for the adverse selection, inventory control and search costs they incur in absorbing and remarketing the block.

Large block trades produce a marked disruption to liquidity. Bid-ask spreads increase significantly and depth decreases significantly after large market orders are executed. In the market adjustment around large trades, the size quotes posted by liquidity providers are found to play a more important role in futures markets than in equity markets. The adjustment in market liquidity occurs primarily through changes in quoted depth levels for the interest rate and equity index futures contracts in the sample. Large trades also have a sizeable impact on the bid-ask spread for the equity index contract, similar to that reported by Koski and Michaely (2000) for NYSE-listed equities. Liquidity returns to previous levels more quickly for the futures contracts that are written over short and medium-term interest rates and that are the most liquid, in terms of the average trade size and the average depth at the best prevailing quotes. These findings are consistent with Moulton (1998), who finds that the return of liquidity to base levels is significantly related to security-specific attributes such as the risk profile of the underlying asset, trading activity and spread width.

Block trades appear to intensify the adverse selection problem, with some market participants better equipped than others to interpret the information signal provided by a
block. The adverse selection problem is evident in the elevated price volatility, flurry of quote revisions and disruption to market liquidity prompted by block trades. The liquidity adjustment results also suggest that there is greater information asymmetry around block sales than around block purchases of the four contracts analysed in this dissertation. As predicted by Mann and Ramanlal (1996), limit order traders lower their size quotes, rather than widen the bid-ask spread, as a first response to the decrease in market liquidity caused by a block trade. For the interest rate contracts, locals appear to maintain lower size quotes for up to two minutes to manage the adverse selection problem and protect themselves against unwanted inventory. Only when the size quotes drop to minimum threshold levels after block trades, as is the case for the equity index contract, do they resort to wider spreads. Subsequently, spreads are much sooner to begin recovering than market depth in this case. These liquidity supply responses indicate that the liquidity cost of a large futures trade is mainly a pecuniary externality borne by other traders by impairing their continued ability to trade. Prices are only inclined to stabilise as this liquidity externality evaporates and the new information in the block is worked into quote prices incrementally over several limit order amendments.

In futures markets, the speed of adjustment in response to unscheduled large trades is as rapid as Ederington and Lee (1995) and Kim and Sheen (2001) report it is in response to new information relevant for bond pricing contained in scheduled macroeconomic announcements. The market response to block trades exhibits several features in common with the two-phase response of the United States Treasury market to the arrival of public information portrayed by Fleming and Remolona (1999). In particular, (i) there is a lull in trading activity up to the time the block trade arrives; (ii) prices adjust sharply to the block; (iii) the moments in which prices adjust sharply are accompanied by a marked disruption to liquidity; (iv) the sharp initial price change is followed by a surge in trading volume that persists along with high price volatility; and (v) liquidity returns to normal levels once a consensus price is reached. Most market participants seem to draw similar price implications from the unexpected component of a block trade, so that the initial price adjustment reflects a large common component in the shift in participants’ expectations. The precise implication of each block is open to interpretation, however, which differs among traders depending on their analytical ability and customer order flows. The residual disagreement among traders provides the catalyst for the surge in trading volume together with the high volatility and disruption
to liquidity after blocks, in the same way that Fleming and Remolona describe for macroeconomic announcements. The recovery in liquidity accelerates as the initial uncertainty about whether the block is based on information begins to subside and liquidity providers respond to the increased demand for immediacy post-block.

The research presented in this dissertation demonstrates that: (1) tax effects are as pervasive in the futures market as they are in the cash market; (2) the adjustment of the underlying stock prices to market-wide information is facilitated by price discovery in the futures market; and (3) futures markets respond to the information contained in large block trades. These results provide a guide to arbitrageurs, investment managers, brokers and regulators who are interested in the efficiency of the information transmission mechanism between the spot and futures markets and how futures markets form prices and provide liquidity in response to large trades.