



# SUBMISSION TO THE PRODUCTIVITY COMMISSION – CHILDCARE INQUIRY

## IMPROVING MATCHING PROCESSES IN THE ECEC SECTOR

A CONSORTIUM OF



Australian Government  
The Treasury



Department of  
Treasury and Finance



FACULTY OF  
BUSINESS &  
ECONOMICS

## **About the Centre for Market Design**

The Centre for Market Design (CMD) is a collaboration between the Commonwealth Treasury, the Victorian Department of Treasury and Finance and the University of Melbourne.

The CMD brings together leading academics with real-world policy problems to design, test and implement tailor-made solutions to a range of important and intractable policy problems.

The CMD utilises a scientific process known as economic design which integrates conceptual insights gained from the economic theory of markets, experimental economics and econometrics, to address the complexities specific to each policy problem.

The research objectives of the CMD are to:

- support an innovative microeconomic policy agenda through the design of policy mechanisms which rely on fundamental and applied economic research;
- build capability in market design and experimental economics in participating universities and jurisdictions; and
- undertake research in market design and its associated academic disciplines, and to publish in high quality refereed academic journals.

In support of these primary objectives the CMD will:

- create collaborative linkages between researchers and policy experts;
- provide access to research infrastructure and experimental economics laboratory facilities;
- provide access to a worldwide network of expertise and advice on market design issues;
- train a new generation of researchers and policy experts in market design and its supporting disciplines; and
- show leadership in market design and its application to policy within Australia and internationally.



# EXECUTIVE SUMMARY

The Centre for Market Design (CMD) is currently progressing a research project regarding the design of efficient matching markets in the Early Childhood Education and Care (ECEC) sector. While this work was ongoing at the time the submission was lodged, the CMD offers the following insights that may be of interest to the Commission as it develops its inquiry into the efficiency of the ECEC sector.

- Initial analysis suggests that the current matching processes used to allocate placements in the ECEC sector lead to inefficient outcomes for market participants, and levy costs on the economy more generally. As such, by considering ECEC allocation processes as part of its review, the Commission may identify opportunities to enhance the efficiency of the ECEC sector.
- The CMD's analysis suggests that neither centres nor parents have sufficient incentives to reform the sector to improve efficiency.
- Progress has been made in matching market theory, supported by empirical evidence, to provide solutions that address identified inefficiencies in the ECEC sector. These include:
  - *Increased use of centralised/coordinated processes.* Coordination between centres could reduce the transaction costs faced by parents and centres in allocating capacity.
  - *Employing tailor-made algorithms to allocate capacity.* Algorithms that elicit parents' truthful preferences for placements create value by achieving fairer matching and more efficient matches (e.g. the welfare of the group of parents is maximised).
- To the best of our knowledge, there are no studies that quantify (empirically or theoretically) the benefits of employing efficient matching market processes in the ECEC sector. The CMD is working towards implementing a matching market pilot in the sector to help demonstrate benefits (and costs) of efficient matching processes for parents, centres and society more broadly. The CMD expects that the costs of implementing the pilot will be low and that it can be achieved within existing government policies and reforms.
- Preliminary analysis suggests that other reforms may be needed to ensure efficient matching is employed in the ECEC sector, particularly in allocating places that become available throughout the year. The CMD has extensive experience in implementing price-based mechanisms (e.g. auction systems) to more efficiently allocate market capacity in several real-world settings.
- CMD representatives would value the opportunity to meet with the Commission to discuss its ongoing research project in the ECEC sector and the CMD's experience in applying price-based mechanisms and market design.

# INTRODUCTION

Although markets are the predominant institution employed in western economies to allocate resources, Governments sometimes specifically preclude monetary valuations from determining how resources are distributed, often as a result of moral or ethical considerations. In Australia, human organ transplants (e.g. The Australian Kidney Exchange), some human services programs (e.g. public housing) and university, school, preschool and childcare placements are not allocated through price-based processes. In other markets – such as entry-level labour markets – even though prices/wages play an important role in clearing the market, they may not be the primary driver in matching applicants to preferred jobs. In these and other relevant sectors, criteria such as individual preferences are crucial in allocating available resources.

Whilst there may be reasons to allocate human organs and public housing on the basis of need and tertiary placement on the basis of ability, the allocation processes developed for these goods and services are subject to the same economic efficiency and efficacy considerations that apply to regular markets. Whether willingness to pay, need or preferences are elicited, the institutions employed must resolve underlying information and incentive problems before it can be argued that the ensuing transactions are efficient.

Significant theoretical advances have been made to improve the efficiency of allocation systems where monetary valuations are not used. Referred to as matching markets, these advances allow economists to design the rules and processes that facilitate stable and strategy-proof outcomes. The 2012 Nobel Prize in Economic Sciences was awarded to Alvin Roth and Gale Shapley for developing the theoretical basis and successful application of matching markets<sup>1</sup>.

The Centre for Market Design (CMD) has three matching market projects included in its current work program<sup>2</sup>. One of these projects focuses on the design and application of modern matching markets in the Early Childhood Education and Care (ECEC) sector. Although this project was ongoing at the time the submission was lodged, the CMD can provide a number of insights relevant to questions raised in the Commission's issues paper, including:

- The extent to which parents are experiencing difficulties accessing ECEC services that meets their needs/preferences and whether there are particular categories of care, times, locations or circumstances for which accessing ECEC is more difficult.
- How parents identify vacancies or choose which ECEC service to use (e.g. My Child website and other privately operated websites).

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<sup>1</sup> For more information, see the background paper: "Stable Allocations and the Practice of Market Design", accessible at: <[http://www.nobelprize.org/nobel\\_prizes/economic-sciences/laureates/2012/advanced-economicsciences2012.pdf](http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2012/advanced-economicsciences2012.pdf)>

<sup>2</sup> For more information on the CMD's current work program see our "2013 Annual Report", accessible at <[http://cmd.org.au/about/annual\\_reports](http://cmd.org.au/about/annual_reports)>

This submission focuses on the allocation of ECEC placements, particularly in the Long Day Care (LDC) sector. Section 1 includes a discussion of the processes used to allocate placements, discusses the incentives of participants within the current matching system, and identifies ways that problems might be addressed. Section 2 describes the objectives of the matching market pilot that is progress at the CMD. The final section identifies some other issues relevant to the allocation of placements that may be of interest to the Commission in its deliberations.

# 1. ALLOCATION OF ECEC CAPACITY

The allocation processes that have been developed in the ECEC sector do not utilise open, price-based mechanisms to allocate placements at centres. Because these processes will influence who receives each placement, how transaction costs are borne and ultimately economic efficiency, this aspect of the ECEC sector deserves consideration as part of the Commission's inquiry.

## 1.1 CURRENT ALLOCATION PROCESS

Placement at an ECEC centre entitles the parent to specific rights and obligations with respect to childcare and early childhood development. Currently, there is no standardised system to allocate these placements resulting in a decentralized and uncoordinated matching system.

A stylised description of the iterative matching process that operates within parts of the ECEC sector is provided below. It is particularly relevant to the Long-Day Care (LDC) segment of the sector.

### Stage 1: Information gathering

- *Parents* gather information about centres of interest, including visits to centres and interviews with centre staff.
- *Centres* often ask parents to specifically indicate their intention to accept an offer made by the centre.

### Stage 2: Wait listing

- *Parents* submit multiple applications to preferred centres. To maximise offers, parents would typically not reveal their true preference for individual centres to centre administrators (e.g. the parent describes every centre as their first choice). Parents would like to leave each centre administrator with the impression that they would take up an offer if it were offered.
- *Centres* place applicants on their waiting list. Waiting lists are not shared between establishments unless establishments are part of a network<sup>3</sup>. Some establishments ask for an up-front (often non-refundable) deposit from parents to be placed on their waiting list<sup>4</sup>.

### Stage 3: Allocating placements at the beginning of the school year<sup>5</sup>

- *Centres* offer parents placements for their child. These offers are not coordinated across establishments, with regard to either the number or timing of offers (excluding some networks). Parents are notified of an offer and acceptance date.

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<sup>3</sup> Currently, localised 'networks' for ECEC services only coordinate offers for centres operated by their respective organisation (e.g. council, commercial, etc.).

<sup>4</sup> Centres charging parents for being placed on a waiting list represents a strategy for centres to recoup (at least some of) the transaction costs borne by them from an inefficient matching process.

<sup>5</sup> This represents a key period when a significant amount of vacancies are filled.

- *Parents* receive offers from centres that may or may not represent their most preferred placement. Parents find themselves in a difficult position of deciding whether to accept an offer not knowing whether a more preferred centre will subsequently make an offer. Centres typically require advance payment of fees (e.g. one to two months) as part of the acceptance process.
- *Centres* receive acceptances, and fill vacancies.

#### Stage 4: Allocating placements continuously throughout the year

- *Parents* that accepted a placement at the beginning of the school year may attempt to secure a vacancy at a more preferred centre throughout the year.
- *Centres* make offers to wait listed parents.

Anecdotal evidence indicates that this iterative process results in the following outcomes:

#### Impact on parents

- *Decisions made without full information* – the dispersed timing of offers and acceptances results in parents making decisions without information about the possible alternatives available.
- *High transaction costs* – the current system involves high search, application and negotiation costs. This is due to: incentives within the system to over-apply to centres; parents employing tactics ‘outside the rules’ to try and improve their placement; and increased stress, particularly when deciding which offers to accept due to the uncertainty of the non-coordinated offers.
- *Strategic behaviour* – the current rules and processes lead parents to give false signals and misrepresent their preferences.
- *Fairness* – parents perceive the current allocation system to be unfair because there are incentives to secure placements by working outside the official system.
- *Inefficient matching* – parents may not be allocated to a centre that accords with their preferences, even if a vacancy exists at a more preferred centre.

#### Impact on centres

- *High administration costs* – centres incur costs associated with:
  - managing waiting lists – multiple rounds (e.g. informal iterations) are required to clear waiting lists and fill placements;
  - managing strategic behaviour – centres incur costs because it is rational for parents to act strategically to improve their placement; and
  - high levels of churn – high churn rates are observed throughout the year.
- *Unclear demand signals* – because of strategic behaviour, waiting lists provide low quality information about demand for placements.

- *Underutilised capacity* – multiple rounds of offers, reluctant acceptances and reoffers can leave capacity underutilised at least in the short term.

### Impact on the ECEC sector

To the extent that the current ECEC sector allocates placements in a way that could be improved through subsequent bilateral negotiation (between parents), it can be argued that it is not Pareto efficient. This imposes costs on the economy in the form of: longer travel times for some parents; reduced workforce participation for the economy; high transaction costs for parents; high administration costs for centres; and inefficient investment in childcare capacity, amongst others.

## **1.2 MARKET FAILURE IN THE MATCHING SYSTEM**

This preliminary assessment of the current ECEC matching process indicates that parents and centres are currently unable to transact efficiently and this is likely to impose costs on the economy. In order to identify how these issues should be addressed, it is necessary to establish whether they are likely to resolve themselves naturally over time.

This section discusses whether participants in the ECEC sector (e.g. parents and centres), have sufficient incentives to resolve the problems identified with the current matching process. It is noted that in many domains of the economy, individuals have incentives to decrease transaction costs which results in markets evolving as efficient and robust institutions. In other markets, however, efficient institutions will not evolve because the incentives of individuals do not align with efficient social outcomes as a result of the existence of public goods and externalities, a lack of competition or other transactional complexities.

Anecdotal evidence and theory suggests that parents suffer the most from an inefficient matching process within the ECEC sector for the reasons identified above (e.g. high transaction costs, inefficient matches, etc.). However, parents are transitory players and each parent's benefit from changing the system is dwarfed by the enormous costs of collective action faced by parents. As such, reform of the matching system is very unlikely to be driven by parents.

The primary concern of centres is to meet their organisational objectives, for instance maximising profit or community access to their services. Centres, therefore, have incentives to address those complexities that impose significant costs on their business. However, they will be reluctant to develop solutions to address more systematic inefficiencies.

This suggests that neither parents nor centres have sufficient incentives to reform the system-wide problems identified in the ECEC matching process.

## **1.3 IMPROVING ECEC SECTOR EFFICIENCY**

This submission notes that advances in the theory and application of matching markets could be applied to increase economic efficiency in the allocation of places within the ECEC sector. Two potential opportunities have been identified. The first is the introduction of a centralised system that allows coordination of offers between unrelated establishments. The second relates to the design of rules that underpin the

allocation mechanism (e.g. an algorithm) to identify an efficient allocation of matches between parents and centres. These are each described in more detail below.

### **1.3.1 Efficiency advantages of a coordinated matching system**

Where location contributes to the formation of preferences, as is the case with ECEC services, some level of coordination between centres will be needed to allow efficient matches to occur.

A 'localised network' approach (e.g. council area) is likely to capture some of the benefits of a coordinated matching system, and may be associated with low implementation costs. However, the way that centres interact with each other, including networks involved and the rules of participation, are important design problems that affect the efficiency of the sector.

Currently, some centres operate as standalone establishments and others exist within a commercial, NGO or local government affiliate. Localised networks for ECEC services (e.g. kindergartens and LDCs) only coordinate offers for centres operated by their respective organisation (e.g. council, commercial, etc.). As such, these networks do not include all relevant services in the area (e.g. private services, community services, etc.) and their spatial boundaries do not necessarily correspond with the diverse spatial preferences of parents.

The benefits of coordination include the following:

- *Certainty about the timing of offers.* Matches can be made at a specific, scheduled point in time, and all offers can be made simultaneously. This prevents parents from having to make choices about whether to accept offers for placements without full information about offers they will receive in the future.
- *Lower administration costs.* In a more coordinated system, parents may only be required to apply for placements once, lowering transaction costs. In addition, less resources may be needed by centres to, firstly, manage waiting lists and, secondly, to manage those parents that attempt to engage in tactics 'outside the rules' to improve their placement.
- *Improved information about demand.* Coordinated timing of offers will lead to clearer and more informative demand signals to the sector as a whole, and to individual centres. This information could be used to inform investment decisions (e.g. beyond utilisation of existing capacity). In addition, coordinated offers could allow enhanced utilisation of existing capacity. Currently, regulations require centres to follow carer-to-child ratios for each category of childcare. These were introduced as part of the National Quality Framework. These carer-to-child ratios lead to lumpy labour costs faced by centres. For example, in the current uncoordinated system a centre may not deem it profitable to offer one additional place for a child as this may require incurring the cost of an additional carer. In a system that provides coordinated timing of offers, these lumpy investment decisions can be ameliorated because offers can be bundled together at one point in time.

For more detail comparing the current decentralised matching system with a coordinated system, see the CMD's attached file note ('Decentralised vs. Centralised Matching'). A coordinated system would not exclude the ability for centres to operate with independent priorities (e.g. a centre that specialises in a particular service, etc.).

### **1.3.2 Efficiency advantages of a tailor-made matching algorithm**

While centralisation may provide some administrative benefits as a result of greater coordination, this will not address all inefficiencies in the allocation process. The rules and processes that define how an allocation system operates will have a significant influence on the information individuals provide, the final allocation of placements, and ultimately the system's efficiency. As such, it is important that the matching processes or algorithms are carefully designed to ensure they promote efficient matching.

Internationally acclaimed matching algorithms that have been successfully applied in various fields can be employed in the ECEC sector to improve the efficiency of matches and provide fairness.

#### **Text box 1: The successful application of matching market theory**

Matching algorithms that are immune to strategic behaviour and that elicit truthful revelation of preferences from individuals tend to persist in the real world because of their efficiency-enhancing properties. Examples include long standing matching algorithms that allocate placements for resident interns and medical specialists across parts of the UK and the US and for lawyers in some Canadian provinces<sup>6</sup>. In addition, matching algorithms have been in use for some time in Australia to allocate graduate lawyers, as well as in Victoria to allocate a range of medical graduates, including interns, radiographers and nurses. Lastly, in 2005 the Boston Public School system adopted a sophisticated algorithm to allocate students to school places. The success of this trial led other school groups in the US (notably in New York and Denver) adopting the matching model.

The 2012 Nobel Prize in Economic Sciences was awarded to Alvin Roth and Lloyd Shapley in acknowledgment for advances in matching theory and application of matching markets in the real-world, which included organ donor exchange, the schools sector and some post tertiary (medical and legal) labour markets<sup>7</sup>.

An efficient, tailor-made algorithm could improve welfare in the ECEC sector if it has the following properties:

- *Pareto efficiency*. The algorithm will maximise welfare across all parents. Although some parents will not receive their top match, matching algorithms are designed to match individuals to their highest possible match, subject to available capacity. For example, a set of matches is considered Pareto efficient when overall welfare

<sup>6</sup> Roth, Alvin E., "The Economist as Engineer: Game Theory, Experimental Economics and Computation as Tools of Design Economics", Fisher Schultz lecture, *Econometrica*, 70, 4, July 2002, p.1343-46.

<sup>7</sup> For more information, see the background paper, "Stable Allocations and the Practice of Market Design", <[http://www.nobelprize.org/nobel\\_prizes/economic-sciences/laureates/2012/advanced-economicsciences2012.pdf](http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2012/advanced-economicsciences2012.pdf)>, accessed 31 January 2014.

cannot be improved from bilateral trades of placements outside of the matching process (e.g. there are no benefits from parents trading their placement with another parent within the system). For individual parents, this will result in better matches that may lead to reduced commuting times and allow them to engage more efficiently with the workforce.

- *Truthful revelation of preferences leading to a fairer matching process.* If the matching algorithm is designed effectively, then parents' best strategy is to reveal their preferences truthfully. This leads to fairer matching since there are no benefits from participants 'gaming' the system. If this were not the case, participants would develop strategies to improve their match (e.g. either participants don't reveal their true preferences or engage in unilateral trades outside of the allocation process) at a cost to others in the system. This type of behaviour erodes the efficiency of the system. A system that is perceived as fair by participants is likely to have longevity.
- *Improving competitive pressures on centres to innovate and improve quality and pricing.* The ongoing truthful revelation of preferences will provide clearer demand signals to childcare centres and to ECEC policy makers, which provides incentives for the sector and centres to innovate (e.g. improved service offerings, more affordable childcare, etc.)

In some parts of the ECEC sector, where a coordinated system employs a matching process, it is very likely that this is being implemented administratively rather than through a dynamic, tailor-made algorithm that has these efficiency properties.

## 2. THE CMD MATCHING MARKET PILOT

In its current state, the ECEC allocation process prevents parents and centres from matching efficiently. Economic theory suggests that efficiency in the ECEC sector might be improved if coordinated matching processes were employed and if matching algorithms were designed to encourage truthful revelation of preferences.

While the implementation of efficient matching markets are likely to have benefits in the ECEC sector, to the best of our knowledge, there are no studies that quantify these benefits (empirically or theoretically). As such, the degree to which intervention in this industry would be worthwhile is yet to be determined, especially given that implementation of tailor-made matching processes is likely to be associated with development and administrative costs.

The CMD is developing a pilot which seeks to demonstrate (and as much as possible quantify) the potential benefits of employing efficient matching market process within the ECEC sector. The CMD's pilot has three key objectives:

- To demonstrate (to parents, centres and Government) the benefits of employing efficient matching processes.
- To demonstrate how efficient matching processes will be employed in a real-world setting (e.g. the ECEC sector).
- To collect and analyse data from ECEC sector participants that will facilitate a meaningful comparison between outcomes from the matching market pilot and outcomes from status quo matching processes.

The CMD's project to develop a matching pilot in the ECEC sector is underway, and progress has been made on the following work streams:

- *Theory* – applying matching market theory to the ECEC policy settings (completed).
- *Algorithm* – designing and building an appropriate tailor-made algorithm to be employed in the ECEC sector (progressing).
- *Stakeholder engagement* – engaging relevant government departments and the ECEC sector to identify participants for the proposed pilot (on-going);
- *Implementation* – implementing the tailor-made algorithm in the real world<sup>8</sup> (yet to begin); and
- *Evaluation* – evaluation of the pilot through surveys to help demonstrate (and where possible quantify) the magnitude of the benefits and costs of a more efficient matching algorithm for parents, centres and the economy more broadly (yet to begin).

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<sup>8</sup> As part of this process, the CMD will design, create and install the software needed for the pilot.

It should be noted that the CMD is considering pilot models that will have a low-cost of implementation and are consistent with other government priorities and reforms.

Should evaluation of the pilot indicate significant benefits for participants, there are a number of potential avenues for further implementation of efficient matching processes in the ECEC sector. Some of these include:

- industry-led implementation through a peak industry body;
- other localised networks adopting efficient matching processes; or
- consideration of Government intervention to further progress efficient matching processes across the ECEC sector.

The CMD would value the opportunity to meet with the Commission to discuss the CMD's developing matching market pilot in the ECEC sector.

## 3. OTHER OBSERVATIONS

The Commission's issues paper raised several questions around the role that price plays in allocating childcare capacity and determining user-based fees, including:

- What is the extent of price competition between providers and the effect this has had on fees and the quality of services provided?
- What flexibility do providers have around price in response to demand and/or meet the particular care and learning needs of children?
- What are the key barriers inhibiting an expansion in ECEC services where demand is highest, development of more flexible ECEC, or alternative models of care?

The following issues broadly relate to these aspects of the Commission's issues paper.

### **3.1 ALLOCATING PLACEMENTS AT THE BEGINNING OF THE SCHOOL YEAR THROUGH A PRICE-BASED PROCESS**

The Commission's inquiry provides an opportunity to investigate the advantages and disadvantages of price-based allocation processes at the beginning of the school year. It is noted that many of the complexities associated with the allocation of placements at centres (such as co-location of siblings) can be accommodated in modern auction design. It is also noted that a price-based allocation system would create a range of equity issues. While the CMD has not completed any research on the application of price-based allocation processes in the ECEC sector, the CMD has significant expertise in auction design should the Commission wish to explore this idea in more detail.

### **3.2 ALLOCATING PLACEMENTS THROUGHOUT THE YEAR**

While parents generally aim to secure a long term arrangement for their child at a centre or centres, individual ECEC placements may become available at any time throughout the year. This may occur for a host of reasons (e.g. families move, illness, changed employment circumstances, etc.). While individual centres can offer unplanned vacancies to other parents, currently there is no formal or coordinated process to make these placements visible to the market, or to encourage efficient allocation of available places.

The policies of many centres require that the responsible parent pays upfront for the allocated place at their centre for a period of time (e.g. fortnightly or periodically in advance), regardless whether their child attends the centre over the entire period. This may be a reasonable condition given the preference for certainty by both parents and centres in the ECEC sector.

Although the CMD has not completed research in this area, it appears there may be several areas that the Commission may wish to explore to improve efficiency of

placements throughout the year, benefiting both centres and parents. These include: clarification of property rights (i.e. enabling parents to sell/buy placements for unused childcare slots on a short-term basis or otherwise); attention to the information complexities (i.e. parents currently cannot see where vacancies exist for ad-hoc care); clarification of the policy environment; and the architecture of the allocation mechanism employed. Since the process to allocate placements through the year is particularly uncoordinated, any flexible and visible system made available to centres and parents could lead to better utilisation of available capacity and greater efficiency of placements.

### **3.3 USER-FEE CHARGES**

It is unclear the role that competitive pricing plays in determining the user-fee charges for ECEC services. For example, anecdotal evidence indicates that broadly similar prices are observed for ECEC services – particularly for LDC services – across different locations once variable costs (e.g. rent, etc.) are considered. In addition, anecdotal evidence indicates that some centres in the ECEC sector may be pricing different service offerings at fairly similar prices despite potentially very different labour costs (having regard to the carer-to-child ratios as outlined in the National Quality Framework).

Should services in the ECEC sector be more competitively priced, there are potentially positive market dynamics that could occur, benefiting parents, centres, and the sector more broadly. These include:

- *Greater market response to broad market demand.* Where demand for services is high it is expected that additional services and/or new providers will come on stream to meet this increase in demand.
- *Greater market response to various service and quality demands.* Different service providers could meet the demand of specific segments of the market (e.g. very high quality service, flexible hours of care, etc.).