

Essays on decision theory and economic efficiency

Ariane Charpin

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Essays on Decision Theory and Economic Efficiency

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Introduction générale

Cette thèse de doctorat comporte trois chapitres regroupés en deux parties distinctes. La première partie, composée d'un chapitre, teste les modèles théoriques de décision en situation de risque sur des données réelles pour identifier la théorie qui permet la meilleure description des choix des individus. Le seconde partie, composée de deux chapitres, examine deux questions de recherche liées à l'efficacité économique. Le premier chapitre consiste en une étude rétrospective d'une fusion ayant eu lieu en France dans le secteur des transports urbains. Elle se concentre sur l'effet de cette fusion sur les coûts des opérateurs. Le second chapitre examine l'impact d'une hausse de la discrétion (au sens de pouvoir discrétionnaire du décideur) dans les procédures de sélection des entreprises dans les appels d'offres sur la productivité des opérateurs sélectionnés. Toutes les questions abordées dans cette thèse sont traitées avec une perspective empirique permise par la construction de bases de données uniques. Dans cette introduction, nous présentons la motivation du travail effectué et les principales contributions de cette thèse.

Partie 1. Modèles de choix dans l'incertain

Les individus prennent constamment des décisions en situation de risque. Un exemple est le choix entre les options de traitement médical proposées par les médecins. Est-ce que je préfère choisir l'option 1, qui me permet de guérir complètement mais qui fonctionne seulement dans la moitié des cas, l'option 2, qui permet une guérison partielle mais fonctionne systématiquement ou l'option 3, qui consiste à ne pas

faire de traitement et espérer la guérison complète observée dans un cas sur cent ? Chaque option comporte une ou plusieurs conséquences possibles auxquelles sont associées des probabilités. Les individus choisissent entre les options en fonction de leurs préférences, notamment leur attitude face au risque. En économie, l'étude des choix en situation de risque pose deux questions : comment les individus doivent-ils se comporter face à des choix risqués ? Et comment les individus se comportent-ils ? La première question est normative, la seconde descriptive. Ce travail de doctorat s'intéresse uniquement à la dimension descriptive des comportements des individus.

Le modèle classique de la décision en situation de risque est le modèle d'espérance d'utilité de Neumann and Morgenstern [1947]. D'autres modèles théoriques comme le modèle d'utilité dépendante du rang (Quiggin [1982]) ou la théorie des perspectives cumulées (Kahneman and Tversky [1979], Tversky and Kahneman [1992]) ont émergé suite à la constatation que, dans les expériences en laboratoire, les individus font des choix systématiquement incompatibles avec la théorie de l'utilité espérée (Allais [1953], Kahneman and Tversky [1979]).

La théorie des perspectives cumulées est actuellement le modèle préféré de la littérature expérimentale car des preuves que les décideurs pondèrent les probabilités de façon non linéaire comme dans la théorie des perspectives cumulées ont été fournies par de nombreuses expériences (voir Camerer and Ho [1994], Tversky and Kahneman [1992], Wu and Gonzalez [1996], Gonzalez and Wu [1999] et Abdellaoui [2000]). La théorie s'est également avérée capable de rationaliser les comportements observés dans les laboratoires qui ne pouvaient pas être expliqués par l'utilité espérée comme l'assurance probabiliste (voir Wakker et al. [1997]). Certaines personnes se sont cependant demandé si les résultats de la littérature expérimentale se généralisaient aux données du monde réel (voir List [2003], Levitt and List [2008]). Ils pensent que les biais sont moins probables en présence de grands enjeux, d'expérience et de concurrence.

Les études existantes reposant sur des données du monde réel utilisent généralement des données d'assurance, de finance et de paris ou de jeux. Cicchetti and Dubin [1994] présentent des preuves que la décision de souscrire à une assurance contre le risque de dysfonctionnement de la ligne téléphonique au domicile est compatible avec la théorie de l'utilité espérée. Barseghyan et al. [2013] montrent que la pondération non linéaire des probabilités joue un rôle central dans le comportement des ménages dans le choix de l'assurance auto et habitation. Kliger and Levy [2009] constatent également que la théorie des perspectives cumulées est mieux ajustée à leurs données que l'utilité espérée et l'utilité dépendante du rang en utilisant des données sur les options d'achat de l'indice S&P500. À l'aide de données provenant de jeux télévisés, Post et al. [2008] montrent que les préférences dépendent du point de référence de sorte qu'elles présentent des caractéristiques du modèle de la théorie des perspectives cumulées. List [2003] et List [2004] fournissent la preuve que bien que les consommateurs inexpérimentés se comportent comme dans la théorie des perspectives cumulées, l'expérience du marché amène le comportement des traders expérimentés proche des prédictions néoclassiques. Au contraire, Pope and Schweitzer [2011] montrent que les golfeurs professionnels très expérimentés, confrontés à des gains élevés et à une concurrence intense, présentent une aversion à la perte, comme le prédit la théorie des perspectives cumulées.

Contributions du premier chapitre

Notre travail apporte une contribution à cette littérature dont les conclusions restent ambiguës. L'objectif de ce chapitre est de discriminer entre la théorie standard du choix individuel en économie (théorie de l'utilité espérée de Neumann and Morgenstern [1947]) et les théories comportementales, qui sont plus générales que l'utilité espérée et sont capables d'expliquer des comportements en ajoutant notamment que les décideurs transforment les probabilités lors de l'évaluation de la valeur des perspectives risquées. Ce travail vise à déterminer si le gain apporté par les modèles

comportementaux ne se produit pas au prix de trop de complexité.

Les paris sur les courses de chevaux sont un bon candidat pour étudier les décisions prises en situation de risque dans une situation réelle. En effet, parier sur un cheval implique de faire un choix entre des alternatives clairement identifiées, chaque alternative étant associée à un résultat monétaire. L'alternative qui se produit est observée publiquement après une courte période de temps. Les choix sont effectués de manière répétée par un grand nombre de participants et une information abondante et complète est disponible sur les probabilités associées aux différents résultats possibles.

Notre analyse s'appuie sur un jeu de données unique sur les paris hippiques de l'opérateur de paris français de 2013 à 2015. Les principales contributions de l'article sont les suivantes.

Premièrement, l'une des découvertes les plus solides de la littérature utilisant les données sur les paris hippiques est que les cotes associées aux chevaux reflètent très bien leurs valeurs intrinsèques, sauf que les favoris (chevaux ayant de fortes chances de gagner) ont tendance à être sous-estimés tandis que les outsiders (chevaux ayant une probabilité de gagner relativement faible) sont surestimés (Sauer [1998]). En conséquence, les rendements espérés sur les outsiders sont plus faibles que sur les favoris. J'étudie dans un premier temps l'existence de ce biais, appelé biais favori-outsider, en France, ce qui n'a pas encore été fait.

Deuxièmement, je teste les résultats de Jullien and Salanié [2000] dans un contexte et à une période différents. Jullien and Salanié [2000] montrent, en se concentrant sur les paris simples au Royaume-Uni où le système de bookmakers prédomine, que la théorie des perspectives cumulées décrit mieux le comportement d'un agent représentatif que les théories de l'utilité espérée et de l'utilité dépendante du rang. Contrairement à la fonction de pondération des probabilités habituelle en S inversé,

ils trouvent peu de preuves de l'existence d'un effet de certitude et d'un changement de concavité des fonctions de pondération de probabilité qu'ils estiment. Ils établissent également que l'utilité dépendante du rang n'apporte pas d'amélioration par rapport à l'utilité espérée.

Troisièmement, je surmonte l'une des limites de l'article de Jullien and Salanié [2000] liée au fait qu'ils n'ont pas pu mettre en œuvre les tests statistiques appropriés pour comparer les modèles. Cette nouveauté est une amélioration majeure puisque la comparaison des modèles est l'objectif principal du chapitre.

Quatrièmement, j'assouplis certaines des hypothèses du modèle de Jullien and Salanié [2000] car le système français est un système de pari mutuel et non un système reposant sur des bookmakers. Enfin, je vérifie également la robustesse des résultats à certaines des hypothèses du modèle en utilisant les caractéristiques des courses.

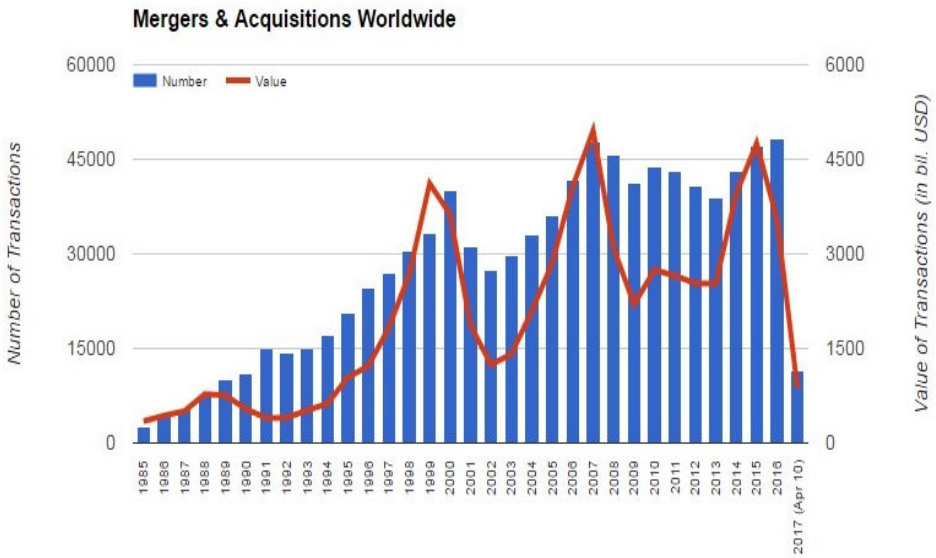
Je montre d'abord que le biais favori-outsider est présent en France. Je trouve, en outre, que les théories comportementales de la décision en situation de risque, c'est-à-dire la théorie des perspectives cumulées et la théorie de l'utilité dépendante du rang, sont mieux adaptées pour expliquer le comportement des parieurs observé dans les données que l'utilité espérée. Ce résultat fournit la preuve que les parieurs pondèrent les probabilités de façon non linéaire lorsqu'ils font des choix. En utilisant la théorie des perspectives cumulées, je trouve une pondération significative des probabilités dans le domaine des pertes et une pondération linéaire des probabilités dans le domaine des gains, ce qui est cohérent avec le résultat de Jullien and Salanié [2000] mais contredit les résultats des expériences qui trouvent une pondération similaire des probabilités dans les domaines des gains et pertes (Tversky and Kahneman [1992], Abdellaoui [2000]).

Partie 2. Efficacité économique

La seconde partie de ce travail s'intéresse à deux questions spécifiques liées à l'efficacité économique. Nous estimons d'abord l'effet d'une concentration entre deux grandes entreprises du secteur des transports urbains sur leurs coûts. Nous étudions ensuite l'impact de la discrétion dans les procédures d'appels d'offres sur la sélection des opérateurs, en particulier leur productivité. Le premier chapitre de cette partie s'inscrit dans la littérature dédiée aux analyses rétrospectives des opérations de concentration. Le second chapitre de cette partie s'inscrit quant à lui dans la littérature sur les procédures de sélection des opérateurs dans les appels d'offres et leurs conséquences.

Analyses rétrospectives des opérations de concentration

Figure 1: Fusions annoncées dans le monde entre 1985 et 2016 (source : Nasdaq.com)



Le graphique 3 montre qu'au cours des trois dernières décennies, le nombre d'opérations de concentration dans le monde a été multiplié par trois. Dans le même temps, le contrôle des concentrations par les autorités de concurrence s'est développé. En France, il a commencé à être mis en place à partir de la fin des années 90, avec

notamment l'obligation de notifier les opérations de concentration au-dessus d'un certain chiffre d'affaires en 2002, puis l'adoption de lignes directrices relatives au contrôle des concentrations en 2005.

Les autorités de concurrence s'intéressent aux opérations de concentration situées au-dessus d'un certain seuil de chiffre d'affaires. Elles cherchent à déterminer si ces opérations risquent de porter atteinte au surplus du consommateur. La pratique des autorités de concurrence consiste généralement à examiner si une opération de concentration emporte des effets anticoncurrentiels en se concentrant sur une potentielle augmentation des prix (et plus rarement sur une potentielle réduction de l'innovation ou de la qualité et de la diversité de l'offre). Les autorités de concurrence étudient également si les opérations sont justifiées par des gains d'efficacité compensant les atteintes à la concurrence éventuellement constatées. Elles décident ensuite de la suite à donner à l'opération en choisissant de l'autoriser, de l'interdire ou de l'autoriser sous certaines conditions.

Le contrôle des concentrations par les autorités de concurrence s'est accompagnée de la naissance d'une littérature économique évaluant rétrospectivement les fusions les plus controversées, c'est-à-dire les fusions qui ont fait l'objet d'analyses approfondies par les autorités de concurrence. Les études ex post sont utiles pour aider les autorités de concurrence à améliorer leurs futures décisions (voir la discussion de Duso and Ormosi [2015]). En évaluant si les décisions des autorités de concurrence (intervention ou absence d'intervention) ont atteint leurs objectifs et en cherchant à comprendre pourquoi si ce n'est pas le cas, les études ex post contribuent à rendre le contrôle des concentration plus efficace. Les résultats des études rétrospectives peuvent par exemple être comparés aux résultats des méthodes quantitatives et des théories mobilisées par les autorités de concurrence lors des analyses ex ante. Ces comparaisons ont l'intérêt d'aider les autorités de concurrence à tester la validité et la précision de leurs méthodes et de vérifier si les instruments utilisés ex ante pour

prédire les effets potentiels des fusions sont appropriés, précis et efficaces. Elles peuvent mettre en évidence que certains tests économiques ne sont pas appropriés pour délimiter le marché dans certains secteurs, que les hypothèses retenues pour modéliser certains aspects d'un marché n'étaient pas adaptées, ou encore établir la précision des prédictions des simulations ex ante des concentrations. Les études rétrospectives contribuent également au débat sur la question de savoir si la politique de la concurrence est trop indulgente ou trop stricte (Baker and Shapiro [2008] vs. Crandall and Clifford [2003]). Enfin l'existence d'études rétrospectives pourrait améliorer la transparence des décisions et la responsabilité des autorités de concurrence et permettre aux autorités de communiquer sur le travail qu'elles effectuent afin notamment de justifier leur action.

Comme les analyses ex ante des autorités de concurrence, les articles de recherche se concentrent principalement sur l'impact des fusions sur les prix. La méthodologie empirique la plus utilisée est la méthode des doubles différences, qui consiste à comparer les évolutions de prix entre un groupe affecté par la concentration et un groupe non affecté par la concentration, avec l'hypothèse qu'en l'absence de fusion les prix dans les deux groupes auraient suivis des tendances parallèles. Parmi les études ex post les plus récentes, on peut citer les études suivantes.

Aguzzoni et al. [2014] estiment l'effet d'une fusion entre deux des plus importantes chaines de magasins de jeux-vidéo au Royaume-Uni. En utilisant la méthode des doubles différences, ils comparent l'évolution des prix des parties à la fusion avec celle des sept plus importants concurrents, en distinguant différents types de jeux. Ils trouvent que la fusion a conduit à une réduction des prix à la fois des nouveaux et des anciens jeux et que le déclin est plus marqué pour les parties à la fusion que pour les concurrents, ce qui suggère l'existence de gains d'efficacité, qui proviennent de la capacité d'obtenir de meilleures conditions auprès des éditeurs et des fournisseurs. Aguzzoni et al. [2016] estiment l'effet d'une fusion entre deux des plus importantes

chaines de magasins de livres au Royaume-Uni en comparant les marchés locaux de vente de livres. Ils comparent le changement de prix après la fusion entre les magasins localisés dans les marchés locaux où les deux chaines étaient présentes avant la fusion et dans les marchés locaux où seulement une chaine était présente avant la fusion en utilisant la méthode des doubles différences. Ils trouvent que la fusion n'a pas entrainé de hausse de prix, ni au niveau local ni au niveau national. Allain et al. [2017] analysent l'impact d'une fusion entre chaines de supermarchés sur les prix de la nourriture. La méthode utilisée compare les changements de prix des parties à la fusion et des concurrents sur les marchés affectés, définis comme les marchés locaux où les deux concurrents sont présents ou alternativement les marchés locaux avec au moins une des parties, et des marchés de comparaison. Ils trouvent une hausse de prix significative à la suite de la fusion à la fois pour les parties et les concurrents. Ashenfelter et al. [2013] estiment les effets sur les prix d'une fusion entre deux fabricants de produits ménagers aux États-Unis. La stratégie empirique repose sur la méthode des doubles différences et compare les prix de plusieurs produits ménagers sur les marchés locaux qui ont connu un changement de concentration et ceux qui n'ont pas été affectés par la fusion. Ils trouvent des hausses de prix pour certains produits.

Les travaux antérieurs utilisent une méthodologie similaire. On peut citer Focarelli and Panetta [2003] and Sapienza [2002] dans la banque de détail, Hastings [2004], Gilbert and Hastings [2005] et Taylor and Hosken [2007] dans la vente de carburant, Borenstein [1990], Kim and Singal [1993], Borenstein [1990] dans le marché du transport aérien ou encore Vita and Sacher [2001] dans les hôpitaux. Un nombre limité d'articles combinent la simulation ex ante des fusions et l'évaluation ex post des effets des fusions par la méthode des doubles différences pour étudier la validité des prédiction des modèles de simulation (voir par exemple Peters [2006], Weinberg [2011], Weinberg and Hosken [2013], Friberg and Romahn [2015] et Björnerstedt and Verboven [2016]).

Peu d'études s'intéressent spécifiquement aux gains d'efficacité. Comme expliqué par Duso and Ormosi [2015], *«[l]'un des éléments les plus spéculatifs du contrôle des concentrations est constitué par les prétentions de gains d'efficacité des parties à la fusion. Pourtant, très peu d'études ont été menées pour déterminer si les économies de coûts escomptées avaient eu lieu après la fusion »*. Les gains d'efficacité sont pourtant un argument central des parties et de leurs conseils devant les autorités de concurrence. Ils peuvent prendre de nombreuses formes, telles qu'une réduction des coûts de transport et de distribution, des économies d'échelle et de gamme, une amélioration de la qualité du management ou de l'utilisation de l'expertise (voir OECD [2016]).

Dans un des premiers articles qui a cherché à estimer les gains d'efficacité d'une concentration, Focarelli and Panetta [2003] mettent en évidence indirectement les gains d'efficacité en comparant les effets de fusions dans les banques sur les prix à court-terme et à long-terme, avec l'hypothèse que les effets anticoncurrentiels se manifestent peu de temps après la fusion tandis que les gains d'efficacité prennent plus longtemps à se matérialiser et à être répercutés sur les prix. Ashenfelter et al. [2015] estiment les effets d'une fusion entre deux grandes brasseries sur les prix, en distinguant les effets de la hausse de la concentration et des gains d'efficacité permis par la réduction des distances entre les brasseries et les magasins et donc des coûts de distribution. Leur résultat indique que la hausse de prix causée par une plus grande concentration est compensée presque en intégralité par les gains d'efficacité, et que les entreprises ont répercuté plus rapidement l'effet du pouvoir de marché que les gains d'efficacité dans les prix. Dranove and Lindrooth [2003] examinent l'effet de concentrations dans les hôpitaux sur leurs coûts en effectuant une différence de différences avec un groupe de contrôle constitué d'hôpitaux sélectionnées à partir de coefficients de propension. Les gains d'efficacité estimés pour les hôpitaux qui restent complètement séparés après la fusion sont nuls mais ceux estimés pour les hôpitaux qui fusionnent notamment leurs rapports financiers et sont régulés comme une seule

entité, ce qui facilite la réorganisation et la rationalisation des services, génèrent des économies de coûts significatives deux, trois et quatre ans après la fusion. Kwoka and Pollitt [2010] analysent les effets d'une vague de fusions dans l'industrie électrique américaine entre 1994 et 2003 sur les coût d'exploitation et les coûts totaux de la distribution d'électricité en effectuant une double différences de mesures d'efficacité calculées avec la méthode non paramétrique d'analyse d'enveloppement des données (*DEA, Data Envelopment Analysis*). Ils trouvent que les fusions ne se sont pas traduites par des baisses de coûts. Brito et al. [2013] effectuent une simulation de fusion dans le secteur de l'assurance pour évaluer l'impact d'une série de fusions dans l'industrie de l'assurance au Portugal sur les prix, en distinguant la hausse du pouvoir de marché et les gains d'efficacité. Ils trouvent que la période post fusion n'est caractérisée ni par une hausse du pouvoir de marché, ni par un changement d'efficacité des entreprises. Ils concluent leur article sur les dimensions importantes à prendre en compte lors des simulations ex ante des fusions, notamment effectuer des analyses de sensibilité sur les coûts marginaux estimés et tenir compte des changements des caractéristiques des produits après les fusions.

Contributions du deuxième chapitre

La revue non exhaustive des études rétrospectives des opérations de concentration montre un grand intérêt pour ce type d'étude et met en évidence qu'aucune de ces études ne porte sur le secteur des transports urbains ou sur la fusion spécifiquement examinée dans le deuxième chapitre de cette thèse, à savoir la fusion entre Veolia Transport et Transdev. Il apparait également que peu d'études portent spécifiquement sur les gains d'efficacité permis par les concentrations. Ce second chapitre de cette thèse, co-écrit avec Joanna Piechucka, contribue ainsi à la littérature économique existante en effectuant une étude rétrospective d'une fusion entre deux opérateurs majeurs de transport urbain en France et en estimant explicitement si cette fusion a donné lieu à des gains d'efficacité.

En 2009, Transdev a choisi de fusionner avec Veolia Transport. Cette fusion a été approuvée par l'Autorité française de la concurrence en 2010 avec des engagements et la transaction a été finalisée en 2011. La nouvelle entité, qui faisait face à un principal concurrent et à trois concurrents plus petits sur le marché, détenait une part de marché de près de 40 %. Alors que l'Autorité de la concurrence française a, dans ses analyses ex ante, principalement mis l'accent sur les potentiels effets anticoncurrentiels de l'opération, la principale préoccupation étant la réduction du nombre de concurrents dans les appels d'offres, les parties notifiantes ont fait valoir que l'opération générerait des gains d'efficacité spécifiques. Ceux-ci étaient liées, d'une part, à la réalisation d'économies de coûts dans l'exploitation des réseaux et, d'autre part, à la possibilité de fournir une offre de services plus étendue grâce à la mise en commun des expériences des parties à l'opération.

L'analyse empirique de ce chapitre repose, comme la plupart des études rétrospectives, sur la méthode des doubles différences. Trouver un groupe de contrôle approprié pour estimer les effets des fusions est généralement un exercice difficile (voir par exemple la discussion de Nevo and Whinston [2010]). L'industrie étudiée dans ce chapitre est adaptée pour appliquer la méthodologie car nous pouvons exploiter les variations entre les réseaux locaux. Nous testons plusieurs groupes de contrôle afin de contrôler la possibilité que les réseaux exploités par les concurrents des parties à la fusion aient réagi à la fusion. Pour identifier plus précisément l'impact de la fusion sur les coûts des opérateurs de transport, nous explorons en outre l'hétérogénéité des effets de coût en exploitant la richesse de nos données.

Dans toutes les spécifications examinées, nos résultats montrent que la fusion n'a pas entraîné de gains d'efficacité pour les parties à la fusion. L'explication est que le choix de Veolia a été fait trop rapidement, la fusion a été mal préparée et les différences de cultures entre les deux groupes ont rendu les clients et les employés réticents à la fusion. Ces explications sont très spécifiques au cas d'espèce. Nous ne pouvons

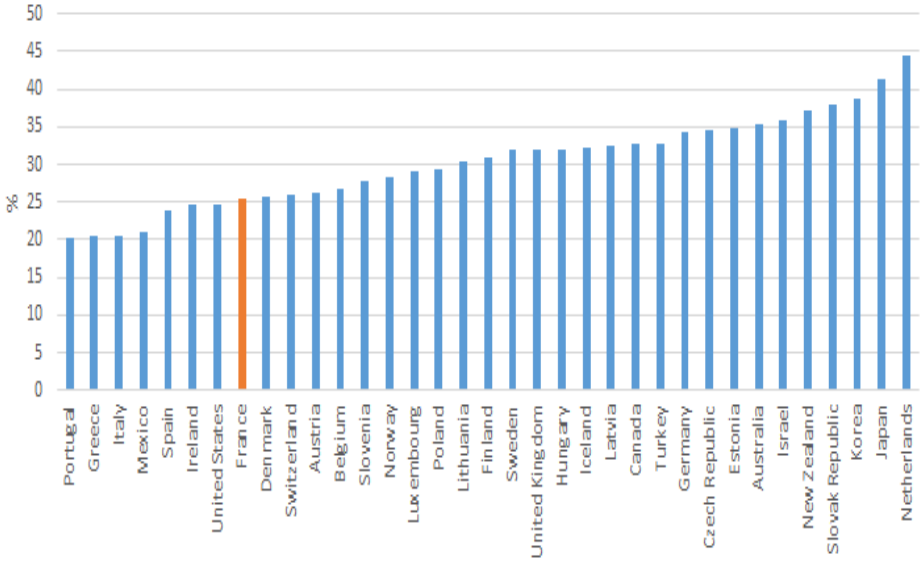
donc pas conclure de nos résultats qu'une modification de la structure du marché dans le secteur des transports urbains ne peut pas conduire à des gains d'efficacité. Nous pouvons cependant mettre en évidence que le rôle joué par le contexte (culture des entreprises, raisons du choix de la cible, perception des clients et des employés, etc.) dans l'absence de concrétisation des gains d'efficacité pose la question de savoir si les économistes et les autorités de concurrence devraient accorder plus de poids au contexte dans les analyses ex ante et les études rétrospectives des effets des concentrations. En effet ces éléments de contexte n'ont dans le cas présent pas du tout été considérés par l'Autorité de la concurrence lors de l'analyse des gains d'efficacité potentiels de la fusion.

La sélection des opérateurs dans les marchés publics

La commande publique correspond aux achats de biens, de services et de travaux effectués par les administrations et les entreprises publiques. Elle mobilise une part importante de l'argent public. Elle représente 12 % du PIB et 29 % des dépenses publiques totales en moyenne dans les pays de l'OCDE et environ 14 % du PIB de l'Union européenne (voir OECD [2017a]). Comme le montre le graphique 4, la part des dépenses de la commande publique dans les dépenses totales des pays en 2015 allait de 20 % au Portugal à 45 % aux Pays-Bas. Elle s'élevait à 26 % en France.

Les montants élevés associés à la commande publique ont conduit les institutions internationales, les gouvernements et les académiques à s'interroger sur l'organisation de la commande publique qui permet d'utiliser au mieux l'argent public, c'est-à-dire d'obtenir les biens ou les services achetés au meilleur rapport qualité/prix. Plus récemment, une autre question liée à l'utilisation de la commande publique comme moyen pour mettre en œuvre des politiques publiques a été soulevée. Elle a notamment été mise en avant par certains pour promouvoir l'innovation (voir OECD [2017b]) ou encore des objectifs écologiques ou sociaux.

Figure 2: Part des dépenses de la commande publique dans les dépenses totales des gouvernements en 2015 (source : graphique effectué à partir des statistiques de l'OCDE)



La littérature académique en économie porte essentiellement sur la question de l'organisation des marchés publics, par exemple le type de contrat à mettre en œuvre ou les procédures de sélection à utiliser, même si le second point a fait l'objet de quelques publications (voir par exemple Saussier and Tirole [2015] qui critiquent notamment l'utilisation de la commande publique pour atteindre des objectifs sociaux, environnementaux ou d'innovation). Elle cherche à contribuer à l'identification des moyens d'action les plus adaptés pour renforcer l'efficacité de la commande publique.

Une littérature conséquente s'intéresse aux implications des procédures de sélection des opérateurs dans les appels d'offres publics. Elle s'intègre dans la littérature sur les asymétries d'information dans les contrats (l'entreprise connait mieux ses coûts et l'environnement économique que l'acheteur public) et l'incomplétude contractuelle (il est impossible de prévoir tous les événements pouvant survenir lors de l'exécution d'un contrat). D'un côté, l'opinion traditionnelle est que les enchères ouvertes, qui sont un mécanisme rigide qui laisse pas ou peu de discrétion aux acheteurs, constituent un mécanisme efficace de sélection des entreprises, car elles rendent plus

probable la sélection du soumissionnaire présentant le coût le plus bas, ce qui réduit le prix gagnant. En utilisant un modèle d'enchères standard, Bulow and Klemperer [1996] montrent qu'une simple enchère donne presque toujours un meilleur résultat qu'une négociation avec moins d'entreprises.

Toutefois, comme l'indique Goldberg [1977], lorsque des transactions complexes sont susceptibles de faire l'objet d'événements inattendus, l'attribution des contrats par le biais de négociations peut être plus souhaitable que les enchères. Manelli and Vincent [1995] illustrent l'avantage de la négociation par rapport aux enchères ouvertes dans certaines circonstances, en particulier lorsque les dimensions qualitatives difficiles à contractualiser du bien acheté sont importantes.

La question examinée par la littérature empirique plus récente est celle du degré de discrétion qui permet les meilleurs résultats. Cette littérature cherche notamment à déterminer, à chaque fois dans des contextes institutionnels bien spécifiques, si lors de hausses du niveau de discrétion des acheteurs publics, se traduisant par une plus grande liberté de l'acheteur public de s'adapter aux circonstances particulières de l'appel d'offres, les effets positifs ont dominé les effets négatifs d'une plus grande discrétion.

Cette littérature souligne le mérite de l'introduction d'une certaine discrétion dans les procédures de sélection. Cameron [2000] teste l'existence potentielle d'un compromis entre le prix et la performance ex post des contrats en utilisant un jeu de données de contrats à long terme conclus avec des services publics d'électricité aux États-Unis. Elle constate que le fait de disposer d'un pouvoir discrétionnaire accru se traduisant par une évaluation plus subjective des offres et la négociation après soumission des offres (par rapport à des procédures d'appel d'offres rigides) entraîne une réduction de prix de 18 % mais également une augmentation de plus de 50 % de la probabilité de rupture du contrat. Coviello et al. [2017] analysent les effets d'une hausse de la discrétion de l'acheteur public, mesurée par la possibilité pour

l'acheteur de décider qui inviter à soumissionner ou non, sur les résultats ex ante et ex post d'appels d'offres dans le secteur de la construction en Italie. En utilisant un modèle de régression à discontinuité, ils montrent, sur leur échantillon principal, qu'une discrétion accrue n'a aucun effet sur les résultats des enchères ex ante (nombre d'enchérisseurs, rabais, taille des gagnants, distance du gagnant à l'acheteur public) et sur la plupart de leurs mesures de performance ex post (durée des travaux, renégociations monétaires). Sur un échantillon réduit plus près du seuil de discontinuité, ils concluent que les effets positifs de la hausse de la discrétion l'emportent plutôt sur les effets négatifs. Un plus haut niveau de discrétion est susceptible de réduire la durée totale des travaux, de conduire à la sélection de plus grandes entreprises et à une réduction du nombre d'entreprises présentant des offres, réduisant ainsi les coûts associés à la sélection des offres. Cependant, un niveau de discrétion plus élevé n'a pas d'effet significatif sur d'autres résultats tels que la remise gagnante, le dépassement des coûts et la probabilité que le projet soit attribué à une entreprise locale. Chever et al. [2017] démontrent que la hausse de la discrétion peut également avoir des bénéfices lors de l'attribution de contrats de faible valeur (donc plutôt simples). Ils mettent en évidence que la restriction de la concurrence à un petit nombre de soumissionnaires lors de l'attribution de contrats de faible valeur vise à répartir les contrats entre des entreprises de bonne réputation et n'entraîne pas de prix plus élevés. Dans l'ensemble, leurs résultats suggèrent que les enchères restreintes, tout en économisant sur les coûts de transaction ex ante, préservent un niveau élevé de concurrence entre les quelques entreprises sélectionnées pour soumettre des offres.

Les preuves empiriques sont partagées sur le point de savoir si la discrétion favorise les comportements de corruption au détriment des coûts ou de la qualité. L'argument est qu'une autorité publique pourrait utiliser de manière préjudiciable son pouvoir discrétionnaire pour favoriser une entreprise donnée et en retirer des avantages personnels, alors que les enchères ouvertes sont considérées comme un instrument permettant de responsabiliser les acheteurs grâce à une plus grande

transparence. Palguta and Pertold [2017] observent qu'en Espagne, lorsque le pouvoir discrétionnaire de l'acheteur est accru par la possibilité de présélectionner des soumissionnaires potentiels, les entreprises dont le propriétaire est anonyme sont plus susceptibles de remporter le contrat. Bandiera et al. [2009] exploitent une expérience menée dans le système italien de passation des marchés publics et concluent que les acheteurs publics bénéficiant de pouvoirs discrétionnaires plus importants sont plus efficaces et ne sont pas plus corrompus que les acheteurs plus réglementés, générant ainsi moins de gaspillage. Il en ressort que l'inefficacité administrative (manque de compétences de l'acheteur ou charge réglementaire excessive, par exemple) apparaît comme une source de gaspillage plus importante que la corruption.

Contributions du troisième chapitre

Le troisième chapitre de cette thèse, co-écrit avec Marion Chabrost, contribue à la littérature qui s'intéresse à la question de l'intérêt d'une plus grande discrétion dans les procédures de sélection des entreprises dans les marchés publics. Dans l'ensemble, cette littérature utilise les résultats des contrats (rabais sur les prix, retards, renégociations, etc.) comme mesure de l'efficacité de différents types de procédures de sélection impliquant différents niveaux de discrétion. Dans ce troisième chapitre, notre mesure d'efficacité ne correspond pas à une ou plusieurs dimensions du résultat du contrat. Nous utilisons la productivité de l'entreprise sélectionnée. Nous pensons que cet indicateur, qui traduit l'efficacité de l'entreprise, reflète sa capacité à fournir le bien ou le service acheté au meilleur rapport qualité/prix. La première contribution de ce chapitre consiste donc à étudier une dimension de l'achat public qui a été négligée jusqu'à présent, qui est l'effet d'un pouvoir discrétionnaire sur la capacité à sélectionner un fournisseur efficace. La deuxième contribution provient de l'implication du résultat en termes de politique publique, à savoir qu'une procédure de sélection qui augmente le pouvoir discrétionnaire est potentiellement en contradiction avec l'objectif principal des marchés publics, qui est d'obtenir le meilleur résultat

au meilleur prix, et avec un potentiel objectif plus large, qui serait de promouvoir la productivité. La troisième contribution du chapitre consiste à identifier le rôle de certaines caractéristiques observées de l'acheteur, du contrat et de l'environnement économique dans le choix d'une procédure, dans la lignée des travaux de Bajari et al. [2009].

L'analyse est effectuée à l'aide d'une base de données unique sur les marchés publics passés en France entre 2006 et 2015. Elle tire parti du cadre réglementaire français en matière de passation des marchés publics, qui a permis le recours à des procédures d'appel d'offres plus souples que les enchères ouvertes, ce qui a introduit plus de discrétion dans les procédures de sélection, à partir de 2004. Dans la plupart des pays, les règles régissant les marchés publics visent à favoriser la transparence et l'efficacité. Dans cette perspective, les institutions internationales, telles que la Banque mondiale et l'OCDE, encouragent le recours à des procédures de passation des marchés concurrentielles et transparentes et, dans de nombreux pays, les règles en matière de passation des marchés publics fixent des seuils au-dessus desquels l'acheteur public doit utiliser des procédures d'enchères ouvertes. En Europe, la Commission européenne a fixé des seuils au-dessus desquels l'utilisation d'enchères ouvertes strictement réglementées est obligatoire. En dessous de ces seuils, les lois nationales s'appliquent. En France, en-deçà des seuils fixés par la Commission européenne, les acheteurs publics sont autorisés à choisir entre une procédure strictement réglementée consistant en une enchère ouverte ou une procédure plus flexible ouvrant la porte à plus de discrétion, appelée procédure adaptée. Cette procédure laisse à l'acheteur une certaine liberté quant à la manière de faire de la publicité, de concevoir l'appel d'offres et de choisir le gagnant, y compris la possibilité de négocier.

Notre principal résultat est que la procédure adaptée conduit à une allocation inefficace des fonds publics aux entreprises les moins performantes par la sélection

d'entreprises moins productives. C'est, à notre connaissance, la première fois que cet effet causal est identifié. Nos résultats sont robustes à plusieurs tests de robustesse qui sont présentés dans le chapitre.

Le mécanisme par lequel la procédure adaptée pourrait conduire à la sélection d'entreprises moins performantes est présenté dans la dernière partie du chapitre. Nous avons identifié trois canaux qui pourraient expliquer notre principal résultat. Premièrement, il se peut que les entreprises choisissent elles-mêmes certaines procédures (auto-sélection). Deuxièmement, il se peut que les acheteurs n'invitent que certains types d'entreprises à soumissionner dans les procédures adaptées. Troisièmement, il se peut que les bassins de soumissionnaires contiennent les entreprises les plus productives dans les deux types de procédures, mais que la sélection des entreprises aboutisse à des résultats différents. Pour faire la distinction entre ces canaux, nous aurions idéalement besoin des identités de tous les soumissionnaires dans les appels d'offres pour comparer les bassins de soumissionnaires dans les deux procédures. Cependant, cette information n'est pas disponible dans notre base de données. Nous examinons donc le nombre de soumissionnaires et les caractéristiques des gagnants, qui sont les informations dont nous disposons. Nos analyses suggèrent que notre résultat s'explique par l'effet de la discrétion dans la sélection des entreprises, même s'il conviendrait d'approfondir l'analyse en examinant tous les soumissionnaires pour tirer une conclusion définitive.

Deux raisons pourraient expliquer pourquoi les acheteurs publics sélectionnent des entreprises moins performantes dans le cadre de procédures adaptées. La première est que l'acheteur public choisit une procédure avec une discrétion accrue afin de pouvoir sélectionner une entreprise qu'il souhaite privilégier (par exemple si l'acheteur public est corrompu), de sorte que l'acheteur public n'essaye même pas de sélectionner une entreprise efficace. La deuxième raison découle de la finalité de la procédure adaptée, qui doit être adaptable aux circonstances de l'achat afin de réduire les coûts

de transaction ex ante, y compris les coûts de publication ou les coûts de sélection des opérateurs. Dans ce cas, un acheteur public choisirait une entreprise moins efficace en utilisant la procédure adaptée car il dépenserait moins dans le processus de sélection. En d'autres termes, la perte de productivité pourrait être considérée comme le coût d'une réduction des coûts de transaction ex ante. Si l'acheteur public est corrompu ou cherche à favoriser une entreprise donnée, la procédure adaptée est purement inefficace. Si l'acheteur public utilise une procédure adaptée pour économiser sur les coûts de transaction ex ante, il faudrait comparer les coûts de transaction ex ante avec les résultats ex post des procédures pour déterminer si un pouvoir discrétionnaire accru dans les marchés publics est en moyenne bénéfique.

General Introduction

This doctoral thesis is composed of three chapters grouped into two distinct parts. The first part, consisting of a chapter, tests the theoretical models of decision under risk on real data to identify the theory that allows for the best description of the choices of individuals. The second part, consisting of two chapters, examines two research questions related to economic efficiency. The first chapter consists of a retrospective study of a merger that took place in the urban transport sector in France. It focuses on the effect of this merger on the operators' costs. The second chapter examines the impact of an increase in discretion (in the sense of discretion of the decision-maker) in selection procedures of firms in public tenders on the productivity of the selected operators. All the questions addressed in this thesis are treated with an empirical perspective allowed by the construction of unique databases. In this introduction, we present the motivation of the work done and the main contributions of the thesis.

Part 1. Models of choices under risk

Individuals constantly make decisions in situations characterized by risk. An example is the choice between medical treatment options offered by doctors. Do I prefer option 1, which allows me to heal completely but only works in half of cases, option 2, which allows a partial cure but works systematically or option 3, which consists of not doing any treatment and hope for the complete healing observed in one out of every hundred cases? Each option has one or more possible consequences associated

with probabilities. Individuals choose between options based on their preferences, including their attitude toward risk. In economics, the study of choices in situations of risk raises two questions: how should individuals behave when faced with risky choices? And how do people behave? The first question is normative, the second descriptive. This doctoral work focuses solely on the descriptive dimension of the behavior of individuals.

The classical model of decision under risk is the expected-utility model of Neumann and Morgenstern [1947]. Other theoretical models such as the rank-dependent utility model (Quiggin [1982]) or cumulative prospect theory (Kahneman and Tversky [1979], Tversky and Kahneman [1992]) have emerged following the observation that, in laboratory experiments, people make choices systematically inconsistent with expected utility theory (Allais [1953], Kahneman and Tversky [1979]).

Cumulative prospect theory is currently the favorite model of the experimental literature because evidence that decision makers weight probabilities non linearly as in cumulative prospect theory was provided by many experiments (see Camerer and Ho [1994], Tversky and Kahneman [1992], Wu and Gonzalez [1996], Gonzalez and Wu [1999] and Abdellaoui [2000]). The theory was also found to be able to rationalize behaviors observed in laboratories that could not be explained by expected utility such as probabilistic insurance (see Wakker et al. [1997]). Some people have questioned whether the findings of the experimental literature generalize to real-world data (see List [2003], Levitt and List [2008]). They believe that biases are less likely in the presence of large stakes, experience and competition.

Existing studies using real-world data typically rely on insurance, finance and bets or games market data. Cicchetti and Dubin [1994] presents evidence that decisions to purchase insurance against the risk of landline malfunction are consistent with expected utility theory. Barseghyan et al. [2013] shows that non linear probability weighting plays a central role in the behavior of households in the choice of auto and

home insurance. Kliger and Levy [2009] also finds that cumulative prospect theory better fits their data than expected utility and rank-dependent utility relying on data on call options on the S&P500 index. Using data from game shows, Post et al. [2008] shows that preferences are reference dependent so that they exhibit characteristics of the cumulative prospect theory model. List [2003] and List [2004] provide evidence that although inexperienced consumers behave as in prospect theory, market experience brings experienced traders' behavior close to neoclassical predictions. On the contrary Pope and Schweitzer [2011] shows that highly experienced professional golfers who face high stakes payoffs and intense competition exhibit loss aversion as predicted by prospect theory.

Contributions of the first chapter

Our work contributes to this literature which conclusions remain ambiguous. The goal of the paper is to discriminate between the standard theory of individual choice in economics (expected utility theory by Neumann and Morgenstern [1947]) and behavioral theories, which are more general than expected utility and are able to explain some behaviors by incorporating in particular the fact that decision makers transform probabilities when assessing the value of risky prospects. This work aims at determining whether the gain brought by behavioral models does not occur at the price of too much complexity.

Horserace betting markets are a good candidate to study decisions taken in situations of risk using real-life data. Wagering on a horse indeed involves making a choice between clearly identified alternatives, each alternative being associated with a monetary outcome. The occurring alternative is observed publicly after a short period of time. Choices are made repeatedly by a large number of participants and extensive information is available on probabilities of outcomes.

Our analysis relies on a unique dataset of bets on horseraces of the French betting

operator from 2013 to 2015. The main contributions of the paper are the following.

First, one of the most robust findings of the literature using horserace data is that odds associated to horses reflect their intrinsic values very well, with the exception that favorites (horses with a high chance of winning) tend to be underbet while outsiders (horses with a relatively small chance of winning) are overbet (Sauer [1998]). As a result, the expected returns on outsiders are lower than on favorites. I first study the existence of the favorite-longshot bias in France, which has not been done before.

Second, I test the results of Jullien and Salanié [2000] in a different context and at a different time period. Jullien and Salanié [2000] shows, by focusing on win bets in the UK where the bookmaker system prevails, that cumulative prospect theory describes the behavior of a representative agent better than expected utility and rank-dependent utility theories. Contrary to the usual inversed S-shaped probability weighting function, they find little evidence for the existence of a certainty effect and of a change in concavity of the probability weighting functions that they estimate. They also establish that rank-dependent utility does not improve on expected utility.

Third, I overcome one of the limits of the paper of Jullien and Salanié [2000], which is that they could not implement the appropriate statistical tests to compare the models. This novelty is a major improvement to the paper of Jullien and Salanié [2000] since comparing models is the main objective of the paper.

Fourth, I relax some of the assumptions of the model of Jullien and Salanié [2000] because the French system is a pari-mutuel one and not a bookmaker one. Finally, I also test the robustness of the results against some of the assumptions of the model using the characteristics of races.

I first show that the favorite-longshot bias exists in France. I further find that behavioral theories of decision under risk, that is both rank-dependent and cumulative

prospect theories, are better suited to explain the behavior of bettors observed in the data than expected utility is. This result provides evidence that bettors weight probabilities non-linearly when making choices. Using cumulative prospect theory, I find significant weighting of probabilities in the domain of losses and linear weighting of probabilities in the domain of gains, which is consistent with the result of Jullien and Salanié [2000] but contradicts results from experiments which find similar weighting of probabilities in the gains and losses domains (Tversky and Kahneman [1992] and Abdellaoui [2000]).

Part 2. Economic efficiency

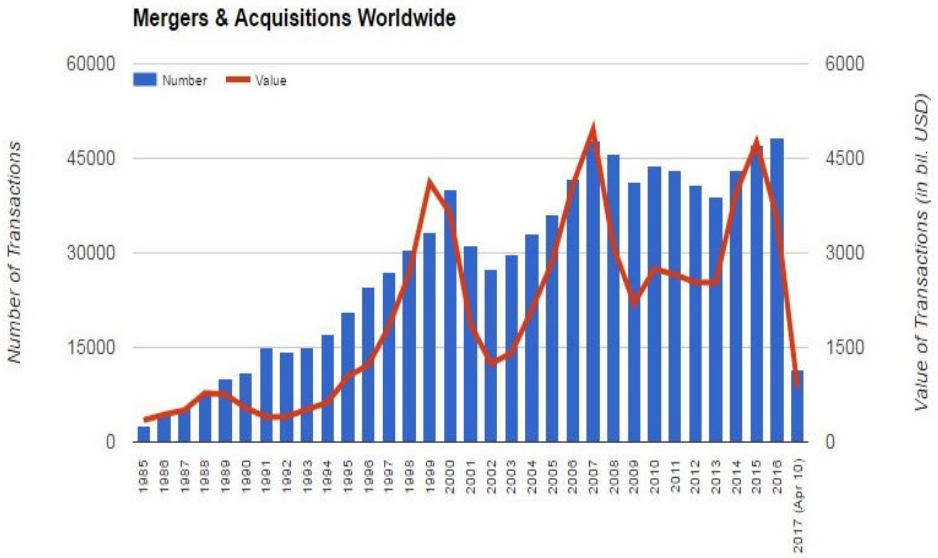
The second part of this work focuses on two specific issues related to economic efficiency. We first estimate the effect of a merger between two large companies in the urban transport sector on their costs. We then study the impact of discretion in tendering procedures on the selection of operators, especially their productivity. The first chapter of this section is part of the literature dedicated to retrospective analysis of concentration operations. The second chapter of this section fits into the literature on selection procedures in calls for tenders and their consequences.

Retrospective analysis of mergers

Figure 3 shows that over the last three decades, the number of mergers and acquisitions in the world has tripled. At the same time, merger control by competition authorities has developed. In France, it began at the end of the 1990s, with in particular the obligation to notify mergers above a certain turnover in 2002, followed by the adoption of merger control guidelines in 2005.

Competition authorities study concentrations above a certain threshold of turnover. They seek to determine whether these transactions are likely to affect the consumer's surplus. The practice of competition authorities generally consists in examining

Figure 3: Mergers announced in the world between 1985 and 2015 (source: Nasdaq.com)



whether a merger carries anti-competitive effects by focusing on a potential price increase (and more rarely on a potential reduction in innovation or in quality or diversity of the products offered). Competition authorities also examine whether the transactions are justified by efficiency gains which compensate for the potential damage to competition. They then decide whether to authorize the merger, to prohibit it or to authorize it under certain conditions.

Merger control by competition authorities was accompanied by the birth of an economic literature retrospectively evaluating the most controversial mergers, i.e., the mergers that have been the subject of in-depth analyzes by competition authorities. Ex post studies are useful to help competition authorities improve their future decisions (see the discussion of Duso and Ormosi [2015]). They contribute to make merger control more effective by assessing whether the decisions of the competition authorities (intervention or lack of intervention) have achieved their objectives and by trying to understand why if this is not the case. The results of retrospective studies can for example be compared with the results of the quantitative methods and theories used by the competition authorities in ex ante analyzes. These com-

parisons have the advantage of helping competition authorities testing the validity and accuracy of their methods and verifying whether the instruments used ex ante to predict the potential effects of mergers are appropriate, accurate and effective. They can highlight that certain economic tests are not appropriate to delimit the market in certain sectors, that the assumptions used to model certain aspects of a market were not adapted, or to establish the accuracy of the predictions of ex ante simulations. Retrospective studies also contribute to the debate over whether competition policy is too lenient or too strict (Baker and Shapiro [2008] vs. Crandall and Clifford [2003]). Finally, the existence of retrospective studies could improve the transparency of the decisions and the accountability of the competition authorities and allows the authorities to communicate on the work they carry out, in particular to justify their action.

Like the ex ante analyzes of the competition authorities, the existing research papers focus mainly on the impact of mergers on prices. The most widely used empirical methodology is the difference-in-differences method, which consists in comparing the evolution of prices between a group affected by the merger and a group non affected by the merger, with the assumption that, in the absence of a merger, prices in both groups would have followed parallel trends. The most recent ex post studies include the following studies.

Aguzzoni et al. [2014] estimates the effect of a merger between two of the largest video game store chains in the UK. Using the difference-in-differences method, it compares the price evolution of the merging parties with that of the seven largest competitors, distinguishing different types of games. It finds that the merger has led to a price reduction for both new and old games and that the decline is greater for the merging parties than for the competitors, suggesting the existence of efficiencies which would come from the ability to get better terms from publishers and suppliers. Aguzzoni et al. [2016] estimates the effect of a merger between two of the largest

book store chains in the UK by comparing local book sales markets. It compares the price change after the merger between stores located in local markets where both chains were present before the merger and in local markets where only one chain was present before the merger using the difference-in-differences method. It finds that the merger did not result in price increases, either at the local level or at the national level. Allain et al. [2017] analyzes the impact of a merger between supermarket chains on the price of food. The method used compares the price changes of the merging parties and competitors in the affected markets, defined as local markets where both competitors are present or alternatively local markets with at least one of the parties, and comparison markets. It finds a significant price increase as a result of the merger for both parties and competitors. Ashenfelter et al. [2013] estimates the price effects of a merger between two household product manufacturers in the United States. The empirical strategy is based on the difference-in-differences method and compares the prices of several household products in local markets that have experienced a shift in concentration and those that have not been affected by the merger. It finds price increases for some products.

Previous works use a similar methodology. We can quote Focarelli and Panetta [2003] and Sapienza [2002] in retail banking, Hastings [2004], Gilbert and Hastings [2005] and Taylor and Hosken [2007] in the sale of fuel, Borenstein [1990], Kim and Singal [1993], Borenstein [1990] in the air transport market or Vita and Sacher [2001] in hospitals. A limited number of papers combine the ex ante simulation of mergers and the ex post evaluation of mergers using difference-in-differences to study the validity of simulation model predictions (see for example Peters [2006], Weinberg [2011], Weinberg and Hosken [2013], Friberg and Romahn [2015] and Björnerstedt and Verboven [2016]).

Few studies focus specifically on efficiency gains. As explained by Duso and Ormosi [2015], *"one of the most speculative elements of merger control is merging parties'*

efficiency claims, yet we have very few studies that examine whether anticipated cost savings took place post merger". Efficiency gains are however a central argument of the parties and their counsels in front of competition authorities. They can take many forms, such as reducing transport and distribution costs, economies of scale and scope, improving the quality of management or the use of expertise (see OECD [2016]).

In one of the first articles that sought to estimate the efficiency gains of a concentration, Focarelli and Panetta [2003] indirectly highlights efficiency gains by comparing the effects of mergers in banks on short-term and long-term prices, with the assumption that anti-competitive effects occur shortly after the merger, while efficiencies take longer to materialize and be passed on to prices. Ashenfelter et al. [2015] estimates the effects of a merger between two major breweries on prices, distinguishing the effects of increased concentration and of efficiencies originating from reduced distances between breweries and stores and hence shipping costs. Its results indicate that the price increase caused by greater concentration is offset almost entirely by efficiency gains, and that firms have passed on the effect of market power more rapidly than efficiencies into prices. Dranove and Lindrooth [2003] examines the effect of several mergers between hospitals on their costs by applying a difference-in-differences methodology with a control group of hospitals selected using propensity score matching. The estimated efficiency gains for hospitals that remain completely separated after the merger are nil but those estimated for hospitals that merge their financial reports and are regulated as a single entity, which facilitates the reorganization and rationalization of services, generate significant cost savings two, three and four years after the merger. Kwoka and Pollitt [2010] analyzes the effects of a wave of mergers in the US electricity industry between 1994 and 2003 on the operating costs and total costs of electricity distribution by performing a difference-in-differences of efficiency measures computed with the nonparametric method of Data Envelopment Analysis. It finds that the mergers did not translate into lower

costs. Brito et al. [2013] conducts a merger simulation in the insurance sector to assess the impact of a series of mergers in the insurance industry in Portugal on prices, distinguishing the increase in market power and efficiency gains. It finds that the post merger period is characterized neither by an increase in market power nor by a change in the efficiency of companies. It concludes on the important dimensions to consider in ex ante mergers simulations, including conducting sensitivity analyzes on estimated marginal costs and taking into account changes in product characteristics after mergers.

Contributions of the second chapter

The non-exhaustive review of retrospective merger studies shows the interest for this type of study and highlights that none of these studies deals with the urban transport sector or the merger specifically examined in the second chapter of this thesis, namely the merger between Veolia Transport and Transdev. It also appears that few studies specifically address the efficiency gains allowed by mergers. The second chapter of this thesis, co-written with Joanna Piechucka, thus contributes to the existing economic literature by carrying out a retrospective study of a merger between two major urban transport operators in France and by explicitly estimating whether this merger resulted in efficiency gains.

In 2009, Transdev selected Veolia Transport to merge. This merger was approved by the French Competition Authority in 2010 with remedies and the deal was closed in 2011. The new entity, which faced one main competitor and three smaller competitors in the market, had a market share of nearly 40%. While the French Competition Authority mostly focused on potential anticompetitive effects, the main concern being the reduction in the number of competitors in competitive tenders, the notifying parties argued that the transaction would generate specific efficiency gains. These were claimed to be linked, on the one hand, to the achievement of cost savings in the operation of networks and, on the other hand, the possibility of providing a more

extensive service offering thanks to the pooling of experience between the parties.

The empirical analysis of this chapter uses, like most retrospective studies, the difference-in-differences method. Finding an appropriate control group to estimate the effects of mergers is usually a great challenge (see for example the discussion of Nevo and Whinston [2010]). The characteristics of our industry suggest a good field for applying the methodology, as we can easily exploit variations in the conditions across local networks. We consider several control groups in order to control for the possibility that the networks operated by the competitors of the merging parties have reacted to the merger. To identify more precisely the impact of the merger on the costs of transport operators, we further explore heterogeneity in the cost effects by exploiting the richness of our data.

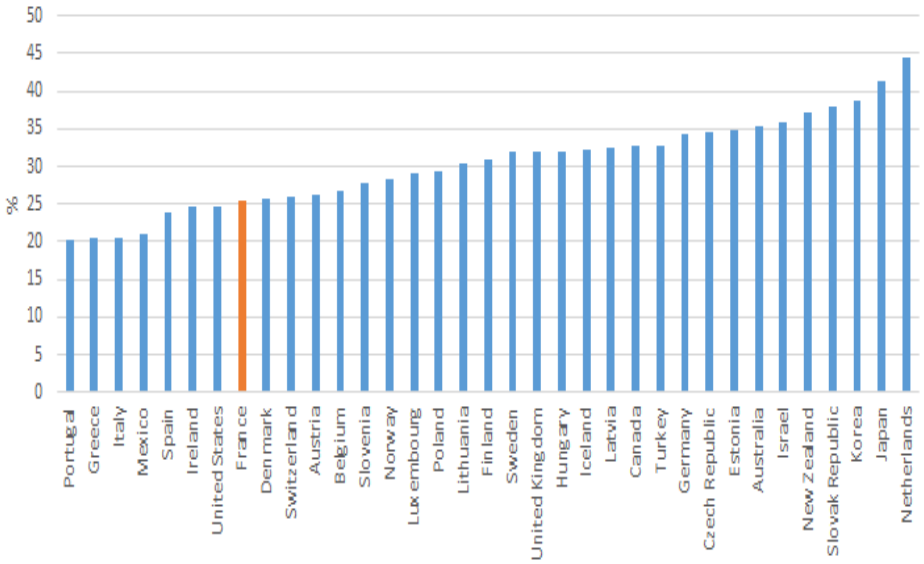
In all specifications, our results show that the merger did not lead to efficiency gains for the merging parties. Our explanation is that the choice of Veolia was made too hastily, the merger was poorly prepared and the differences in cultures between the two groups made both clients and employees reluctant to the merger. These explanations are highly specific to the case at hand. We cannot hence conclude from our results that a change of market structure in the sector of urban transport cannot lead to efficiency gains. Additionally, the role played by the context (culture, choice of the target, perception by clients and employees, operational preparation of the merger, etc.) in the lack of materialization of efficiency gains questions whether the context should be given more weight by economists in their models and by competition authorities in their analysis of potential effects of mergers.

Selection of operators in public procurement

Public procurement is the purchase of goods, services and works by governments and public enterprises. It mobilizes a large share of public money. It accounts for 12% of GDP and 29% of total public expenditure on average in OECD countries and about

14% of GDP in the European Union (see OECD [2017a]). As shown in Figure 4, the share of public procurement expenditures in total country expenditures in 2015 ranged from 20% in Portugal to 45% in the Netherlands. It amounted to 26% in France.

Figure 4: Share of public procurement in total government expenditures in 2015 (source: figure made from OECD data)



The high amounts associated with public procurement have led international institutions, governments and academics to try to determine the organization of public procurement that makes the best use of public money, that is to say that enables to obtain the goods or services purchased at the best value for money. More recently, another issue related to the use of public procurement as a means to implement public policies has been raised. It has been put forward by some to promote innovation (see OECD [2017b]) or ecological or social objectives.

The academic literature in economics focuses on the question of the organization of public procurement, for example the types of contracts to implement or the selection procedures to use, even if the second point has been the subject of a small number of publications (see for example Saussier and Tirole [2015] which criticizes the use of public procurement to achieve social, environmental or innovation objectives). It

seeks to contribute to the identification of the most appropriate means of action to reinforce the effectiveness of public procurement.

A substantial body of literature focuses on the implications of operator selection procedures in public tenders. It fits into the literature on asymmetries of information in contracts (the company knows better its costs and the economic environment than the public buyer) and contractual incompleteness (it is impossible to predict all the events that can occur when executing a contract). On the one hand, the traditional view is that open auctions, which are a rigid mechanism that leaves buyers with little or no discretion, are an effective mechanism for selecting firms because they make the selection of the lowest cost bidder more likely, thereby reducing the winning price. Using a standard auction model, Bulow and Klemperer [1996] shows that a simple auction almost always yields a better outcome than a negotiation with fewer firms would.

However, as Goldberg [1977] argues, when complex transactions are likely to be subject to unexpected events, awarding a contract through negotiation may be more desirable than auctions. Manelli and Vincent [1995] illustrates the benefit of negotiation over open auctions under certain circumstances, in particular when non-contractible quality dimensions of the procured good are important.

The question examined by the more recent empirical literature is that of the degree of discretion that allows the best results. This literature seeks in particular to determine, each time in very specific institutional contexts, whether the positive effects have dominated the negative effects of greater discretion when increases in the level of discretion of public purchasers, resulting in greater freedom for the public purchaser to adapt to the particular circumstances of the tender, have occurred.

This literature emphasizes the merit of introducing a certain discretion in the selection procedures. Cameron [2000] tests for the potential existence of a compromise

between price and ex post performance by using a dataset of long-term power contracts electric utilities have awarded in the United States. It finds that increasing discretion through allowing a more subjective evaluation of bids as well as post bid negotiations (compared to rigid competitive bidding procedures) yields a price reduction of 18% but also an increase in the probability of contract breach by more than 50%. Coviello et al. [2017] analyzes the effect of increased discretion - measured in terms of whether the buyer can decide who to invite to bid or not - over ex ante and ex post procurement outcomes using a dataset of public tenders in construction in Italy. Using a regression discontinuity design, it finds, using its main sample, that increased discretion has no effect on ex ante auction outcomes (number of bidders, rebates, size of the winners, distance of the winner from the public buyer) and on most of their ex post performance measures (duration of the works, monetary renegotiations). In a closer neighborhood of the discontinuity threshold, it finds that the positive effects of discretion may dominate the negative ones. Discretion is likely to reduce the total duration of works, to lead to the selection of larger firms and to a reduction in the number of firms submitting bids, thereby saving costs associated to bid screening. However, a higher level of discretion is found to have no significant effect over other outcomes such as the winning rebate, cost overrun and the probability that the project is awarded to a local firm. Chever et al. [2017] shows that the increase in discretion can also have benefits when tendering low value (hence rather simple) contracts. It demonstrates that the restriction of competition for small value contracts aims at sharing out contracts among pre-qualified firms of good repute and does not result in higher prices. Overall, its results suggest that restricted auctions, while saving on transaction costs, preserve a high level of competition between the 'happy few' firms selected to bid.

Empirical evidence is divided as to whether discretion favors corrupt behavior at the expense of cost or quality. The argument is that a public authority might prejudicially use its discretion to favor a particular business and derive personal benefits

from it, whereas open auctions are seen as an instrument that favors accountability of buyers through greater transparency. Palguta and Pertold [2017] observes that, in Spain, increased discretion through the possibility to preselect potential bidders makes firms with anonymous untraceable owners more likely to win the contract. Bandiera et al. [2009] exploits a policy experiment in the Italian public procurement system and concludes that public buyers endorsed with more discretionary power are more efficient and are not more corrupt than more regulated ones, thereby generating less waste overall. It shows that administrative inefficiency (e.g. buyer's lack of skills or excessive regulatory burden) appears to be a more important source of waste than corruption.

Contributions of the third chapter

The third chapter of this dissertation, co-written with Marion Chabrost, contributes to the literature which is interested in the question of the benefits of a greater discretion in the procedures of selection of the companies in public procurement. Overall, this literature uses contract outcomes (price discounts, delays, renegotiations, etc.) as a measure of the effectiveness of different types of selection procedures involving different levels of discretion. In this third chapter, our measure of effectiveness does not correspond to one or more dimensions of the result of the contract. We use the productivity of the selected company. We believe that this indicator, which reflects the effectiveness of the company, reflects its ability to provide the good or service purchased at the best value for money. The first contribution of the chapter consists in studying a dimension of procurement that has been neglected so far, which is the effect of increasing discretion on the ability to select an efficient supplier. The second contribution comes from the policy implication of the result, namely that a selection procedure which increases discretionary power is potentially in contradiction with the main objective of public procurement which is to get the best outcome at the lowest price, and with one potential broader objective of public procurement,

which would be to promote productivity. The third contribution of the paper is to identify the role of some observed characteristics of the buyer, the contract and the economic environment in selecting a procedure, in line with the work in Bajari et al. [2009].

The analysis is performed using a unique dataset of public procurement contracts in France between 2006 and 2015. It takes advantage of the French regulatory framework for public procurement, which has allowed the use of flexible competitive bidding procedures and hence opened room for discretionary power in 2004. In most countries and organizations, the rules on which public procurement lays on aim at fostering transparency and efficiency. In this perspective, the use of competitive and transparent award procedures are promoted by international institutions (e.g. the World Bank, the OECD) and in many countries, public procurement rules set thresholds for contract value above which the public buyer must use open competitive procedures. In Europe, the European Commission sets thresholds above which the use of strictly regulated open auctions is mandatory. Below these thresholds, national laws apply. In France, below the thresholds set by the European Commission, public buyers are allowed to choose between using a strictly regulated procedure consisting in an open auction, or a more flexible procedure implying more discretionary power, named the adapted procedure. The latter procedure gives some freedom to the buyer on how to advertise and design the tender and how to select the winner, including the possibility of negotiation.

Our main result is that the adapted procedure leads to an inefficient allocation of public funds towards less efficient firms through the selection of less productive firms. The magnitude of the effect is large. This is, to our knowledge, the first time that this causal effect is identified using this identification strategy. Our results are robust to several robustness checks which are presented in the paper.

The mechanism through which the adapted procedure could lead to the selection of

less efficient firms are discussed in the last section of the paper. We have identified three channels which could explain our main result. First, it could be that firms self-select in some specific procedures. Second, it could be that buyers invite only some specific types of firms to bid in adapted procedures. Third, it could be that pools of bidders contain the most productive firms in both types of procedures but that the screening of firms leads to different outcomes. To discriminate between these channels, we would ideally need the identities of all the bidders in the tenders to compare the pool of bidders in the two procedures. However this information is not available in our dataset. We hence look at the number of bidders and the characteristics of the winners, which is the information that is available to us. The analysis suggests that our result is driven by the pure effect of discretion in the screening of firms, even if one would need to deepen the analysis by looking at all the bidders to draw a definite conclusion.

Two reasons could explain why public buyers select less efficient firms in adapted procedures. The first possible reason is that the public buyer chooses a procedure with increased discretion in order to be able to select a firm that he wishes to favor (for example if the public buyer is corrupted) so that the public buyer does not even try to select an efficient firm. The second possible reason comes from the purpose of the adapted procedure, which is to be adaptable to the circumstances of the purchase in order to save on ex ante transaction costs, including publication costs or screening costs. In this case, a public buyer would select a less efficient firm using the adapted procedure because he would spend less in the selection process. Put differently, the loss in productivity can be seen as the cost of reduced ex ante transaction costs. If the public buyer is corrupted or seeks to favor a particular firm, then the adapted procedure is purely inefficient. If the public buyer uses an adapted procedure to save on ex ante transaction costs, one would have to balance the ex ante transaction costs with the ex post outcomes of the procedures to conclude on whether increasing discretion in public tenders is on average beneficial.

CHAPTER 1

Testing Models of Decision under Risk: The Case of Horserace Bettors in France*

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Abstract

One of the most robust findings in the literature using data on horseraces bets is that odds associated to horses reflect their chances of winning very well, with the exception that favorites are underbet while outsiders are overbet. Expected utility theory and behavioral theories of decision under risk compete to explain this finding. This chapter seeks to discriminate between the two classes of models by testing which is the most suited to explain the behavior of bettors observed in the data. Using a unique dataset of bets on horseraces in France, I find that behavioral theories of decision under risk better fit my data than expected utility. This result shows that behavioral theories provide a better representation of choice behavior than expected utility.

Key words: Decision-making, Expected Utility, Cumulative Prospect Theory, Rank-Dependent Utility, Probability Weighting Function, Risk Aversion, Representative Bettor, Favorite-Longshot Bias.
JEL classification: D81, L83.

1.1 Introduction

Horserace betting markets provide a real-life laboratory to study decisions taken in situations of risk. First, wagering on a horse involves making a choice between clearly identified alternatives, each alternative being associated with a monetary outcome. Second, the occurring alternative is observed publicly after a short period of time. Third, choices are made repeatedly by a large number of participants. Fourth, extensive information is available on probabilities of outcomes. Horserace betting markets hence offer the opportunity to test the theoretical framework of decision under risk in a simple, yet real-life situation. In particular, they share many characteristics with very simple financial markets.

A large number of papers have taken advantage of these characteristics. They have studied whether prices associated to horses (odds) reflect their intrinsic values (chances of winning in a given race). One of the most robust findings of the literature is that odds associated to horses indeed reflect their intrinsic values very well, with the exception that favorites (horses with a high chance of winning) tend to be underbet while outsiders (horses with a relatively small chance of winning) are overbet (Sauer [1998]). As a result, expected returns on outsiders are lower than those on favorites. An abundant literature tries to explain the existence of this empirical regularity, called the favorite-longshot bias (see Ottaviani and Sorensen [2008] for a review of the main explanations). In particular, two theories of decision under risk compete to this purpose.

On the one hand, the standard theory of individual choice in economics (expected utility theory by Neumann and Morgenstern [1947]) can rationalize the bias by posing that bettors have, at least locally, a convex utility function for monetary outcomes. On the other hand, behavioral theories, which are more general than expected utility, are able to explain the bias by incorporating the fact that decision makers transform probabilities when assessing the value of risky prospects.

The goal of this chapter is to discriminate between these two classes of models. The question under study seeks to identify which model best explains the favorite-longshot bias. Rank-dependent utility and cumulative prospect theory are general-

izations of expected utility, I hence expect these models to explain the data better than expected utility. This work aims at determining whether the gain brought by behavioral models does not occur at the price of too much complexity.

The stake of the question is that using a model that would be too restrictive or that would be wrong might prevent from understanding commonly observed behaviors or lead to wrong predictions. Behaviors which can only be explained using behavioral models include, for example, the equity premium puzzle in finance, the choice of some menus of premium/deductible in insurance or the labor supply of cab drivers in labor economics.

Our analysis relies on a unique dataset of bets on horseraces of the French betting operator from 2013 to 2015. The main contributions of the chapter are the following. First, I study the existence of the favorite-longshot bias in France, which has not been done before to my knowledge. Second, I test the results of Jullien and Salanié [2000] in a different context and at a different time period. Third, I overcome one of the limits of the paper of Jullien and Salanié [2000], which is that they could not implement the appropriate statistical tests to compare the models. This novelty is a major improvement to the paper of Jullien and Salanié [2000] since comparing models is the main objective of the paper. Fourth, I relax some of the assumptions of the model of Jullien and Salanié [2000] because the French system is a pari-mutuel one and not a bookmaker one. Finally, I also test the robustness of the results against some of the assumptions of the model using the characteristics of races.

I first show that the favorite-longshot bias exists in France. I further find that behavioral theories of decision under risk, that is both rank-dependent and cumulative prospect theories are better suited to explain the behavior of bettors observed in the data than expected utility is. This result provides evidence that bettors weight probabilities non linearly when making choices. Using cumulative prospect theory, I find significant weighting of probabilities in the domain of losses and linear weighting of probabilities in the domain of gains, which is consistent with the result of Jullien and Salanié [2000] but contradicts results from experiments which find similar weighting of probabilities in both gains and losses domains (Tversky and Kahneman [1992] and Abdellaoui [2000]).

This chapter fits into a considerable theoretical and experimental literature motivated by the observation that, in laboratory experiments, people make choices systematically inconsistent with expected utility theory (Allais [1953], Kahneman and Tversky [1979]). Cumulative prospect theory has emerged as the favorite model from the experimental literature. Evidence that decision makers weight probabilities non linearly as in cumulative prospect theory were provided by many experiments (see Camerer and Ho [1994], Tversky and Kahneman [1992], Wu and Gonzalez [1996], Gonzalez and Wu [1999] and Abdellaoui [2000]). The theory was also found to be able to rationalize behaviors observed in laboratories that could not be explained by expected utility. One such example is probabilistic insurance (see Wakker et al. [1997]). This type of insurance policy involves a small probability (say 1 %) that the consumer will not be reimbursed. According to expected utility theory (regardless of the concavity of the utility function), people should pay approximately 99% times as much for probabilistic insurance as they pay for full insurance. But experimental responses show that people are willing to pay much less to compensate for the low chance that the claim will not be paid. This behavior cannot be explained by expected utility but is consistent with the overweighting of small probabilities of prospect theory.

Some people have questioned whether the findings of the experimental literature generalize to real-world data (see List [2003], Levitt and List [2008]). They believe that biases are less likely in the presence of large stakes, experience and competition.

Existing studies using real-world settings typically rely on insurance, finance and bets or games market data. While Cicchetti and Dubin [1994] presents evidence that decisions to purchase insurance against the risk of landline malfunction are consistent with expected utility theory, Barseghyan et al. [2013] shows that non linear probability weighting plays a role in the behavior of households in the choice of auto and home insurance. Kliger and Levy [2009] also finds that cumulative prospect theory better fits their data than expected utility and rank-dependent utility relying on data on call options on the S&P500 index. Using data from game shows, Post et al. [2008] shows that preferences are reference dependent so that they exhibit characteristics of the cumulative prospect theory model. List [2003] and List [2004] provide evidence that although inexperienced consumers behave as in prospect theory, market experience brings experienced traders' behavior close to

neoclassical predictions. On the contrary Pope and Schweitzer [2011] shows that highly experienced professional golfers who face high stakes payoffs and intense competition exhibit loss aversion as predicted by prospect theory.

My chapter is closely related to the literature using horserace data. Jullien and Salanié [2000] shows, by focusing on win bets in the UK where the bookmaker system prevails, that cumulative prospect theory describes the behavior of a representative agent better than expected utility and rank-dependent utility theories. Contrary to the usual inversed S-shaped probability weighting function, they find little evidence for the existence of a certainty effect and of a change in concavity of the probability weighting functions that they estimate. They also establish that rank-dependent utility does not improve on expected utility.

Snowberg and Wolfers [2010] uses an impressively large dataset of pari-mutuel bets in the United States to test predictions derived for expected utility and cumulative prospect theories in the particular case of win bets on complex bets. Its approach is based on the fact that the two theories yield different implications for the prices of complex bets so that by comparing predictions with real prices, the best model can be identified. It finds that the model with non linear probability weighting provides the best description of the data, which suggests that prospect theory permits a better description of the data than expected utility.

The present chapter is organized as follows. Section 2 explains how horserace bets are organized in France. Section 3 describes the data. Section 4 introduces the model and the estimation procedure. Section 5 presents the results. The last section concludes.

1.2 Horserace betting in France

The betting market on horseraces in France is exclusively a pari-mutuel system[1]. The concept of pari-mutuel consists in pooling together all bets corresponding to a race and a bet type, removing a share to cover the taxes and expenses of the betting operator and redistributing the remainder among winning bettors in proportion to

[1]There are no bookmaker in France.

their bets. Final payoffs hence depend exclusively on the total pool, the share kept by the betting operator (the "take")[2] and the stakes attracted by each horse.

The more stakes a horse attracts relative to the total pool, the lower the payoff of a bet on this horse. Payoffs on horses are called odds. For the simplest type of bets (which are the focus of the chapter), which consists in finding the winner of a given race, odds of 1.2 on a given horse and race means that a 1 unit winning bet on that horse returns the bet (1) plus 1.2. Odds hence correspond to net returns of a unit bet. A horse cannot have odds inferior to 0.1.

For a race happening on a particular day, the market opens online at about 5 AM on the day of the race. For a bettor which prefers to go to a specialized store, it starts on the day of the race at the opening of stores. A bettor at the track can only bet about thirty minutes before the beginning of the race. The market closes right before the start of the race. Because of the way odds are computed in the pari-mutuel system, bettors only have access to temporary odds which are computed with the current state of bets and are updated about every minute online.

1.3 Data

Data were collected from pmu.fr between April 2013 and May 2015. PMU (Pari-Mutuel Urbain) is the main operator of bets in France. Online, it gathers 84.8% of the total pool and, in-store, it is a legal monopoly. The dataset records information on bets, races, horses and tracks for races which were the subject of bets offered by the PMU. It contains 33,196 races.

For each race, the dataset encompasses the final payoff of each horse, its rank in the race and many of its characteristics. In addition to the time of day, date and track, races are also characterized by their discipline, types and conditions. The data only contains the payoffs of each horse for winning bets, which are the focus in this chapter.

Since I am interested in modeling the process of decision-making regarding the choice

[2]In addition to the "take", French operators also enjoy "breakage", which is the gain from rounding payoffs downwards to the nearest ten cents.

Table 1.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Races per day	32	9.29	13	80	735
Running horses per race	12	3.31	2	24	23,464
Odds	27	31.79	0.1	998	279,792

of a specific horse in a race, I drop the 7,919 races in which two or more horses in a given race belong to a team, which happens when horses have the same owner or the same trainer. In these cases, all the horses of the team have the same payoff and if one of them wins the race, a bet on any of the horses in the team also wins. Hence the payoff of a horse that is part of a team does not reflect its probability of winning, but rather the probability that any horse in the team wins.

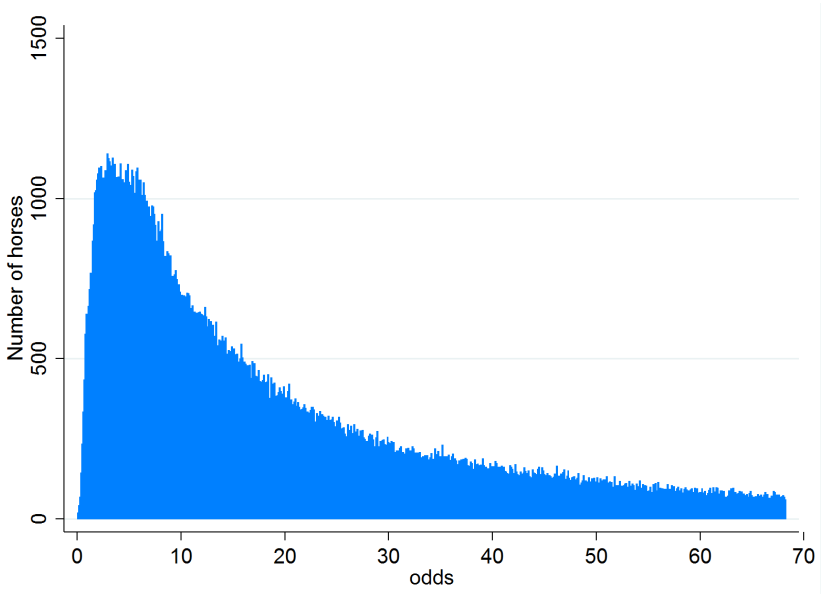
I also remove races in which several horses arrive in the first position, called dead-heats, because I model a race in which only one horse wins the race. I drop races for which payoffs are incomplete or erroneous. It includes races which are not recorded as being over, in which at least one running horse has a missing payoff and for which the final payoff of the winning horse does not correspond to the dividend. I am left with 23,462 races.

As Table 1.1 shows, the average number of races per day amounts to 32. During some days, 80 races take place, while on other days only 13 do. The average number of running horses in a given race is 12. The minimum is 2 while the maximum is 24. Half of the races includes between 9 and 14 running horses. The distribution of odds covers a wide range. The maximum reaches 998 while the minimum is 0.1. The median amounts to 15.4 and the mean to 27. 90% of odds range between 0.1 and 68.4.

Figure 1.1 shows that the sample contains large favorites, with odds between 0.1 and 0.5 (0.2% of the sample), and very long outsiders with odds above 50 (19% of the sample).

Using these definitions, 64% of large favorites and 0.6% of very long outsiders won their race. Alternatively, defining large favorites as horses that attract twice more bets than the second-most-bet horse in their race, large favorites win 44% of the time.

Figure 1.1: Distribution of odds (90 % of odds only)



1.4 Model and estimation procedure

1.4.1 The theoretical model

The model describes the decision of a representative bettor who bets a in a given race and is endowed with an initial wealth M[3]. The choice of a particular horse in the race depends only on its probability of winning and final odds. In a given race r with N horses, the bettor is hence presented with a menu of probabilities and odds $((O_1, p_1), (O_2, p_2), ...(O_N, p_N))_r$, probabilities being non negative and summing to one.

I assume that the menu is known to the bettor when he makes his choice. In practice, final odds are not known until the beginning of the race and the bettor does not have perfect knowledge of probabilities of winning. However, previous studies of horserace bettors imply that bettors have a good knowledge of chances of winning of horses[4] (see Sauer [1998]).

[3]The data do not contain information on the amount bet (a) or on the wealth of bettors (M).

[4]The assumption that bettors know the probabilities of winning of the horses running in the race was tested by reestimating the model on a dataset limited to races in which horses are aged 4 or more and have previously run. In these races, bettors are likely to have a very good knowledge of probabilities of winning of horses. Limiting the dataset to this subsample did not modify the

Writing H_i the action of betting on horse i, the overall value of a bet on horse i, $W(H_i)$, is a number such that the bettor prefers horse i to horse j or is indifferent between horses i and j if and only if $W(H_i) \geq W(H_j)$. The representative bettor is rational in that he bets on the horse with the highest overall value.

Furthermore, I assume that the race is only won by one horse. In this perspective, the few races won by several horses were removed from the sample.

Given the stated assumptions, bettors continue to bet in a given race until odds make them indifferent between betting on any horse in the race and not betting[5]. So in equilibrium:

$$\forall i \in 1, ..., N,\ W(H_i) = w,\ w \text{ constant} \tag{1.1}$$

Let a be the amount bet by the representative bettor, M her initial wealth, O_i the odds associated to horse i and p_i the probability of winning of horse i. I also define u, a continuous and strictly increasing utility function with $u(0) = 0$ and write φ^+ the probability weighting function of gains and φ^- that of losses. Both probability weighting functions are strictly continuous and increasing from the unit interval into itself and satisfy $\varphi^+(0) = \varphi^-(0) = 0$ and $\varphi^+(1) = \varphi^-(1) = 1$. In general terms, the overall value of a bet on horse i can be written :

$$W(p_i, a, M, O_i) = \varphi^+(p_i) * u(M + aO_i) + \varphi^-(1 - p_i) * u(M - a) \tag{1.2}$$

The specific expression of the overall value of a bet on horse i depends on the model of decision-making studied. In expected utility, $\varphi^+(p_i) = \varphi^-(p_i) = p_i$. In rank-dependent theory, $\varphi^-(1 - p_i) = 1 - \varphi^+(p_i)$ and in cumulative prospect theory $M = 0$, so that I assume that the reference point is not betting[6]. More details on

results presented in the chapter.

[5]The equilibrium assumption is stronger in Jullien and Salanié [2000] because odds are chosen by bookmakers (bookmaker system), not by the market (pari-mutuel system). Here my assumption is simply that odds adjust so that bettors are indifferent between all horses at the end of the period. Jullien and Salanié [2000] has to assume that odds are set by bookmakers such that bettors are indifferent between all horses because of the additional assumption that all horses in the race are bet.

[6]This assumption is in line with the literature which commonly assumes that the reference point

Table 1.2: Probability weighting functions

Name	Expression	Restrictions on parameters
Power	$\varphi(p) = p^{\alpha}$	$\alpha > 0$
Tversky and Kahneman [1992]	$\varphi(p) = \frac{p^{\gamma}}{[p^{\gamma}+(1-p)^{\gamma}]^{1/\gamma}}$	$\gamma > 0$
Cicchetti and Dubin [1994]	$\frac{\varphi(p)}{1-\varphi(p)} = (\frac{p}{1-p})^{a_1} * (\frac{p_0}{1-p_0})^{1-a_1}$	$a_1 \geqslant 0$, $p_0 \in [0,1]$
Prelec [1998]	$\varphi(p) = e^{-\beta(-\ln p)^{\alpha}}$	$0 < \alpha \leqslant 1, \beta > 0$
Lattimore et al. [1992]	$\varphi(p) = \frac{\delta p^{\gamma}}{\delta p^{\gamma}+(1-p)^{\gamma}}$	$\gamma > 0, \delta > 0$

each model are given in Appendix A1.

The model is solved using the procedure of Jullien and Salanié [2000] which consists in computing w and then the probability of winning of the horse which actually won the race (p_1), which is in turn used to compute the likelihood function. The procedure used to obtain p_1 is explained for each model in Appendix A2.

1.4.2 Functional form of the utility function

Following Jullien and Salanié [2000], I assume that the utility function has the following CARA form throughout the chapter: $u(x,\theta) = \frac{1-e^{-\theta x}}{\theta}$.

The CARA form allows the estimation of the level of absolute risk aversion θ under the assumption that it is constant. Bettors are risk-loving if $\theta < 0$ and risk-averse if $\theta > 0$. This expression of u is convenient since M, which is not observed, cancels out in the expression of the probability used in the likelihood function.

1.4.3 Functional forms of the probability weighting functions

The common functional forms presented in Table 1.2 are estimated. More information on these functions is available in Appendix A3.

Let Ω be the vector of parameters of the probability weighting functions correspond-

is the *status quo*. For a discussion on how people think about gains and losses, see Köszegi and Rabin [2006], Köszegi and Rabin [2007] and Köszegi and Rabin [2009].

Table 1.3: Definition of the vector of parameters Ω

Name	**Rank-dependent utility**	**Cumulative prospect theory**
Power	$\Omega = \alpha$	$\Omega = (\alpha, \beta)$
Tversky and Kahneman [1992]	$\Omega = \gamma$	$\Omega = (\gamma, \gamma')$
Cicchetti and Dubin [1994]	$\Omega = (a_1, p_0)$	$\Omega = (a_1, p_0, a_1', p_0')$
Prelec [1998]	$\Omega = (\alpha, \beta)$	$\Omega = (\alpha, \beta, \alpha', \beta')$
Lattimore et al. [1992]	$\Omega = (\delta, \gamma)$	$\Omega = (\delta, \gamma, \delta', \gamma')$

ing to each model. Ω, which depends on the shape of the probability function to estimate and on whether the model uses one single probability weighting function (rank-dependent utility) or two probability weighting functions (one for gains and one for losses as in cumulative prospect theory), is defined in Table 1.3.

1.4.4 Estimation

Let θ be the parameter of the utility function and Ω the vector of parameters of the probability weighting functions defined in Table 1.3 for each functional form of the probability weighting function and each model to estimate.

p_1^r is the probability of winning of the horse which actually won race r, with $r = 1, ..., J$. For each r, the likelihood to observe horse 1 winning the race is $l(\theta, \Omega; O_1^r) = p_1(O_1^r; \theta, \Omega)$.

Assuming that outcomes of races are independent and that the expressions of p_1 derived from the model are correct, the probability of observing the sample under study is the product of the J individual densities, which corresponds to the following likelihood function:

$$\prod_{r=1}^{J} p_1(O_1^r; \theta, \Omega) = L(\theta, \Omega | O_1^r)$$

Hence the log-likelihood function:

$$LL = \ln L(\theta, \Omega | O_1^r) = \sum_{r=1}^{J} \ln p_1(O_1^r; \theta, \Omega)$$

The maximum likelihood estimator has the usual asymptotic properties. It is consistent, asymptotically normal, asymptotically efficient and invariant.

$$\hat{\theta} \sim N(\theta_0, [I(\theta_0)]^{-1}), I(\theta_0) = -E_0(\partial^2 \ln L / \partial\theta_0 \partial\theta_0') = -E_0(\partial \ln L / \partial\theta_0 * \partial \ln L / \partial\theta_0')$$

Standard errors are computed using both a bootstrap procedure and the previous formula.

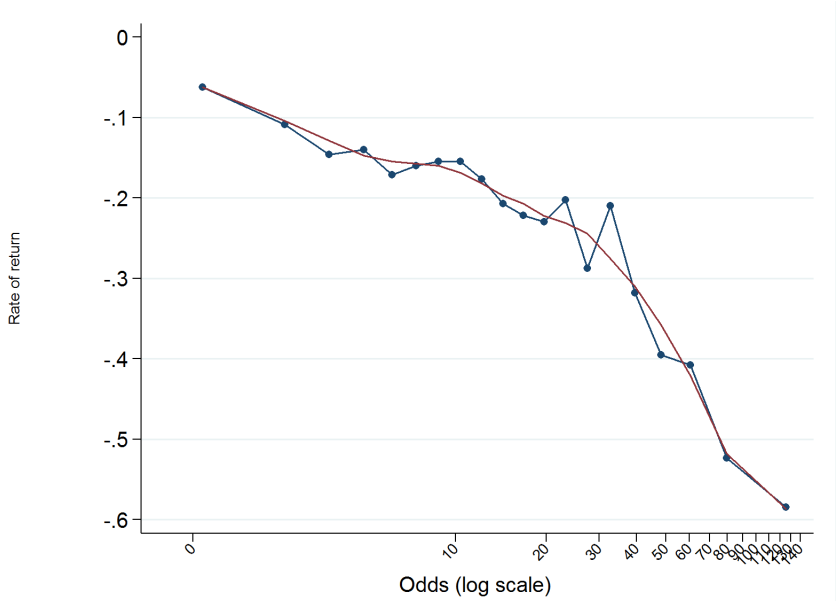
1.5 Results

1.5.1 The favorite-longshot bias

The favorite-longshot bias is the finding that betting on favorites (horses with small odds) yields a higher expected return than betting on longshots (horses with relatively high odds). It has been shown in a large number of papers, starting with Griffith [1949]. It has been observed across various types of races and at different times in North America (McGlothin [1956], Weitzman [1965], Ali [1977], Snyder [1978], Asch et al. [1982], Snowberg and Wolfers [2010]) where the pari-mutuel system prevails, in the UK in both the pari-mutuel and bookmaker systems (Williams and Paton [1997], Jullien and Salanié [2000]), in Australia in both the pari-mutuel (Coleman [2002]) and bookmaker systems (Bird et al. [1987]) and in New Zealand in the pari-mutuel system (Coleman [2002], Gandar et al. [2001]).

The first result of the chapter is that the favorite-longshot bias also exists in France. The expected return for a 1-unit bet on horse i is $R_i = \pi_i * O_i + (1 - \pi_i) * (-1)$, where π_i is the probability of winning of horse i and O_i corresponds to its final odds. The probability of winning of a horse, which is the proportion of times the horse would win the same race repeated an infinitely large number of times, is unknown so

Figure 1.2: Expected returns by odds



I compute expected returns using the approach commonly adopted in the literature (see Coleman [2004]), which consists in grouping all horses of the dataset by either intervals of odds or favorite order (the favorite is in the first group, the second favorite in the second group, etc.) and computing the percentage of winners and the average odds of each group.

Expected returns are graphed in Figure 1.2, horses were grouped by odds percentiles and data is presented on a log-odds scale.

Figure 1.2 shows that returns are not equalized across betting odds: betting on favorites yields a higher rate of return than betting on outsiders. The expected return of betting horses with odds of 127 to 1 is -0.6, whereas it is -0.07 for horses with odds 1.43. Hence payoffs of favorites are not low enough to compensate for their high probabilities of winning, or equivalently favorites are underbet compared to their probabilities of winning. On the contrary, payoffs of outsiders are not high enough to compensate for their low probabilities of winning, or equivalently, they are overbet.

Hence, in a simple model with linear utility and probability weighting functions, the data shows that, in equilibrium, rates of returns are not equalized across horses in a race. Many suggestions have been made to explain this bias, one of which being that

Table 1.4: Expected utility model

	EU model
$a\theta$	-0.014***
	(0.0011)
Max LL	-45,977.315

the simple model does not properly account for the tastes and beliefs of bettors.

1.5.2 Tests of models of decision-making under risk

Expected utility model

The results of the parameters obtained in the expected utility framework, as well as the maximum value of the log-likelihood function are presented in Table 1.4.

$a\theta$ is significantly negative and has a small absolute value, meaning that at least statistically and in the income range in which I test them, bettors exhibit a small and significant taste for risk. The parameter is smaller to the one obtained by Jullien and Salanié [2000] (-0.055) but similar to that of Snowberg and Wolfers [2010] which fits their data with a CARA utility function of parameter -0.017.

A bet of €20 on a horse with odds 10 and probability of winning of 25% is equivalent to the lottery winning €200 with a probability of 25% and loosing 20 with a probability of 75%. The estimated risk-attitude parameter makes a bettor indifferent between this lottery and the sure amount of €38. A risk neutral bettor would be indifferent between the same lottery and the sure amount of €35 so that the behavior of bettors exhibits some risk-love.

Rank-dependent utility model

The results for all functional forms of the probability weighting functions tested are presented in Table 1.5 and graphed in Figure 1.3.

The risk-attitude parameter of the utility function is negative, statistically significant and small in every specification of the rank-dependent utility model.

Table 1.5: Rank-dependent utility models

	Power	**CD**	**LBW**	**Prelec**	**TK**
$a\theta$	-0.011*** (0.0019)	-0.011*** (0.0026)	-0.016*** (0.0029)	-0.013*** (0.0038)	-0.011*** (0.0018)
α	0.97*** (0.014)			0.91*** (0.045)	
a_1		0.99*** (0.026)			
p_0		0.99*** (0.22)			
γ			1.05*** (0.035)		0.98*** (0.011)
δ			1.48*** (0.237)		
β				1.28*** (0.077)	
Max LL	-45,975.289	-45,974.628	-45,972.658	-45,972.481	-45,975.363

Figure 1.3: Rank-dependent theory - Estimated probability weighting functions

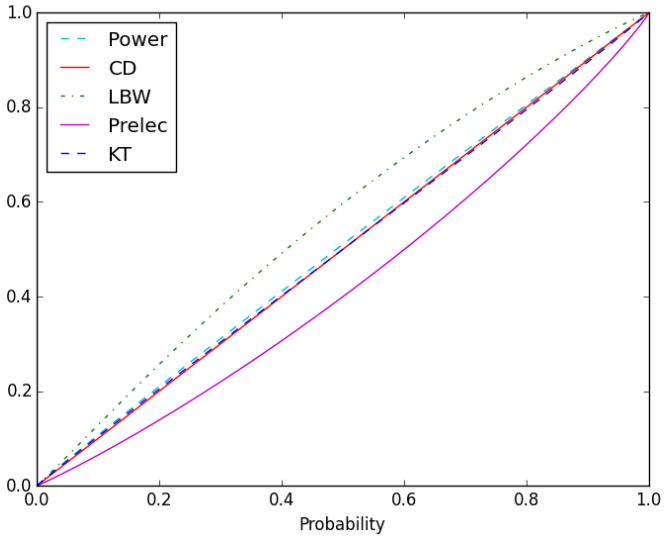


Table 1.6: Comparisons of rank-dependent utility models and expected-utility: statistical tests

	EU	**RD Power**	**RD CD**	**RD LBW**	**RD Prelec**	**RD TK**
AIC	91 957	91 955	91 955	91 951	91 951	91 955
BIC	91 965	91 971	91 979	91 976	91 975	91 971
Likelihood ratio vs. EU		4.1	5.4	9.3	9.7	3.9
Critical value		3.8	6	6	6	3.8

The statistically significant power coefficient differs from and is slightly inferior to 1 (column 1 of Table 1.5) so that $\varphi(p) > p$, which reflects optimism. In the Cicchetti and Dubin function (column 2), a_1 is not significantly different from 1 although it is precisely estimated so that p_0 is not identified and we are back to the expected utility model. In the Lattimore, Baker and Witte function (column 3), γ does not significantly differ from 1 while δ is large and statistically significantly different from 1 at the 5% level. The function is concave and above the 45 degree line, suggesting optimism. In the Prelec function (column 4), α is close to but statistically different from 1, β is large and also statistically different from 1. The function is convex and below the 45 degree line, showing pessimism. In the Tversky and Kahneman function (column 5), γ is close to but statistically different from 1.

The expected utility model is nested within all models. Likelihood ratio tests between the latter and the rank-dependent utility models are presented in Table 1.6.

Likelihood ratio tests show that the rank-dependent utility model statistically significantly better fits the data than the expected utility model in four specifications (power, Lattimore et al., Prelec and Tversky and Kahneman). One can notice that the likelihood ratios are however very close to the associated critical values for the power and Tversky and Kahneman functions. The first conclusion of the analysis is that the rank-dependent utility model better fits the data than the expected utility model. This conclusion differs from Jullien and Salanié [2008] which concluded that rank-dependent utility models did not improve the fit compared to the expected utility model because they found that only the Prelec specification fitted their data better than expected utility.

The results do not permit to conclude on the overall attitude toward risk of bettors, which combines both the risk attitude parameter of the utility function and the

shape of the probability weighting function. As Figure 1.3 suggests, the power and the Tversky and Kahneman functions are extremely close to the diagonal. Table 1.5 shows that attitude toward risk is similar in the expected utility model and the rank-dependent models with power and Tversky and Kahneman weighting functions. The difference between the expected utility model and these models hence does not change anything in terms of behavior of bettors: bettors exhibit a small taste for risk. In Lattimore et al., the risk attitude parameter suggests that bettors are risk-lovers, which is reinforced by the overweighting of probabilities. In the Prelec specification, the risk attitude parameter suggests risk-love but bettors underweight probabilities so that in the end their behavior exhibits risk aversion. To illustrate, the estimated parameters in the Prelec case make a bettor indifferent between the lottery winning €200 with a probability of 25% and loosing 20 with a probability of 75% and the sure amount of €22. In the Lattimore et al. specification, it makes the bettor indifferent between the same lottery and the sure amount of €54. Because risk-neutrality corresponds to the sure amount of €35, the bettor exhibits risk aversion in the first case and risk-love in the second. I am not able to discriminate between the models within the rank-dependent theory as the Akaike information criterion and the Bayesian information criterion, as well as Vuong tests between models, are inconclusive[7].

Cumulative prospect theory

The results for all functional forms of the probability weighting functions tested are presented in Table 1.7. Probability weighting functions for gains are graphed in Figure 1.4 and probability weighting functions for losses in Figure 1.5.

The risk-attitude parameter of the utility function is negative, statistically significant and small in every specification of the cumulative prospect theory model.

The statistically significant power coefficient differs from and is slightly above 1 in the power probability weighting function of gains and below 1 in the power probability weighting function of losses (column 1 of Table 1.7). In the case of gains, it is very close to the diagonal, showing almost no weighting of probabilities. In the case

[7]I can only establish, using a likelihood ratio test, that the Prelec model, within which the power model is nested, performs better than the power function.

Table 1.7: Cumulative Prospect Theory models

	Power	**CD**	**LBW**	**Prelec**	**TK**
$a\theta$	-0,017*** (0.0027)	-0.016*** (0.0048)	-0.015*** (0.0038)	-0.0089** (0.0044)	-0.014*** (0.0021)
α	1.078*** (0.036)			0.75*** (0.26)	
β	0.474*** (0.123)			1.79 (1.35)	
α'				0.99 (2.94)	
β'				0.084 (0.40)	
a_1		1.05*** (0.15)			
p_0		0.99*** (0.25)			
a'_1		0.74 (0.85)			
p'_0		0.99*** (0.31)			
γ			1.05*** (0.085)		0.99*** (0.012)
δ			0.39 (1.00)		
γ'			0.96 (2.35)		0.77*** (0.072)
δ'			16.94 (123.00)		
Max LL	-45,972.178	-45,971.818	45,970.667	-45,970.320	-45,972.613

Figure 1.4: Cumulative Prospect Theory - Estimated probability weighting functions for gains

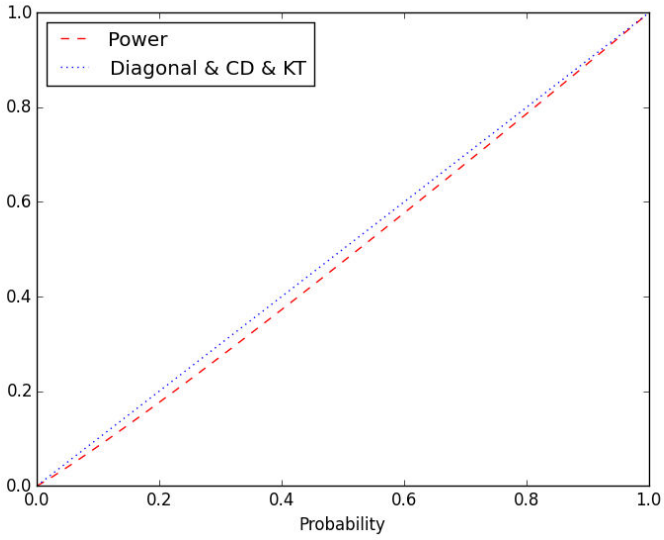
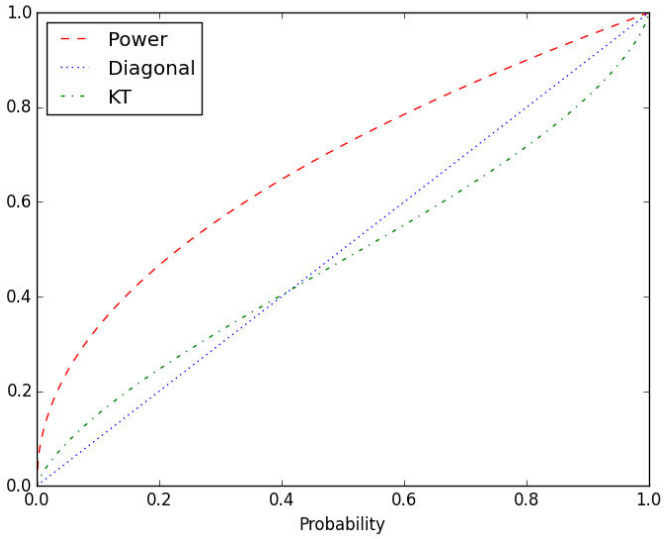


Figure 1.5: Cumulative Prospect Theory - Estimated probability weighting functions for losses



of losses, it is well above the 45-degree line, showing clearly that bettors overweight probabilities of losses, which reflects pessimism.

In the Tversky and Kahneman function (column 5), γ does not differ from 1 in the probability weighting function of gains but it does regarding the probability weighting function of losses, with $\gamma' = 0.77$. The function slightly overweights small probabilities and underweights high probabilities, being hence inverse S-shaped. The curvature of the function is less pronounced than in experimental studies such as Camerer and Ho [1994] which estimated a probability weighting function of gains with parameter 0.56, Tversky and Kahneman [1992] which found 0.61 for gains and 0.69 for losses, Gonzalez and Wu [1999] which found 0.71 for gains and Abdellaoui [2000] which found 0.60 for gains and 0.70 for losses. I hence find more sensitivity to changes in probabilities far from 0 and 1 than those studies and less pronounced certainty and possibility effects.

In the Cicchetti and Dubin function (column 2), a_1 is not significantly different from 1 in the case of gains so p_0 is not identified and the model is equivalent to expected utility. The estimated parameters of the Cicchetti and Dubin probability weighting function of losses have very high standard errors so that I cannot draw any conclusion from their values. Parameters are also too imprecisely estimated in the Lattimore, Baker and Witte (column 3) and the Prelec (column 4) specifications to draw any conclusion. Taking a look at the point estimates, the Prelec and Lattimore, Baker and Witte probability weighting functions of losses exhibit the same shape as the power function does and the Cicchetti and Dubin function is close to the Tversky and Kahneman one. However, the statistical significance of the parameters does not authorize to reject expected utility even if likelihood ratio tests favor these specifications over expected utility.

Likelihood ratio tests between the expected utility model and the cumulative prospect theory models are presented in Table 1.8.

Likelihood ratio tests show that cumulative prospect theory models significantly better fit the data than expected utility in all specifications so that expected utility is clearly rejected. This result is consistent with the conclusions of Jullien and Salanié [2000].

Table 1.8: Comparisons of cumulative prospect theory models and expected-utility: statistical tests

	EU	**CPT Power**	**CPT CD**	**CPT LBW**	**CPT Prelec**	**CPT TK**
AIC	91 957	91 950	91 954	91 951	91 951	91 951
BIC	91 965	91 975	91 994	91 992	91 991	91 975
Likelihood ratio vs. EU		10	11	13.3	14	9.4
Critical value		6	9.5	9.5	9.5	6

Vuong tests between the cumulative prospect theory models using the power and Tversky and Kahneman weighting functions and rank-dependent utility models fall in the inconclusive region except for the rank-dependent utility model with the Prelec probability weighting function for which I find that cumulative prospect theory models are closer to the true model. There is hence slight evidence that cumulative prospect theory performs better than rank-dependent utility theory but I cannot draw any clear-cut conclusion on that.

Jullien and Salanié [2000] finds that the data does not support changing concavity in the probability weighting functions and that the probability weighting function for losses is concave while the weighting function for gains is linear. Camerer [2000] interprets this result as a new explanation for the favorite-longshot bias: "*Bettors like longshots because they have a convex utility and weight their high chances of losing and small chances of winning roughly linearly. But they hate favorites because they like to gamble (u(x) is convex), but are disproportionately afraid of the small chance of losing when they bet on a heavy favorite".*

I find, like Jullien and Salanié [2000], a clear difference between probability weighting of gains, which is quasi linear, and probability weighting of losses, which departs from the 45-degree line.

The power model gives the same result as Jullien and Salanié [2000]: the power function which weights probabilities associated to the utility of losses is concave and well above the diagonal. I also estimate the Tversky and Kahneman function, which was not done by Jullien and Salanié [2000]. It tells a different story since it is inverse S-shaped and close to the diagonal.

I am not able to discriminate between the two models. AIC and BIC of the power

and the Tversky and Kahneman models are very close (see Table 1.8). Furthermore, the Vuong statistic for non nested models falls in the inconclusive region. I hence cannot conclude on the way bettors weight probabilities. I also cannot conclude on the risk attitude of bettors since the two models have different implications in terms of behaviors of bettors. To illustrate, the estimated parameters in the Tversky and Kahneman model make a bettor indifferent between the lottery winning €200 with a probability of 25% and loosing 20 with a probability of 75% and the sure amount of €40. In the power model, it makes the bettor indifferent between the same lottery and the sure amount of €31. In the first case, the bettor hence exhibits a slightly risk-loving attitude, while in the second case, he is clearly risk-averse.

1.6 Conclusion

This chapter relies on the model of Jullien and Salanié [2000] to compare the fit of expected utility theory, rank-dependent utility theory and cumulative prospect theory to French data on horserace bets. It shows that the favorite-longshot bias exists in France. It additionally establishes that both rank-dependent utility and cumulative prospect theory are better suited to explain the data than expected utility is, suggesting that bettors weight probabilities non linearly when making choices. In rank-dependent utility, my results contradict those of Jullien and Salanié [2000] which found no improvement in fit with this model. In cumulative prospect theory, my results confirm those of Jullien and Salanié [2000].

The analysis however suffers from one main limitation. I do not have data on individual bettors so I have to study the behavior of a representative bettor. This is potentially problematic since bettors might differ with respect to their attitude toward risk and their beliefs.

Two interesting research paths could be pursued to complement the study. First, I do not test several shapes of the utility function but rather focus on the probability weighting function. Jullien and Salanié [2000] initiated this possible venue of research by testing a HARA utility function. However because they did not have data on the wealth of bettors, they could not pursue further and finally chose to use a CARA utility function. I face the same limitations due to available data. Second,

my data does not allow to test loss aversion, which is one of the main characteristics of cumulative prospect theory. Information on the amount bet could allow to follow this path in future research.

Appendices

A1 Overall value of a bet in each model

The representative bettor bets a in each race and is endowed with an initial wealth M. The choice of a particular horse depends only on the probability of winning of the horse and final odds written $(O_1, p_1), (O_2, p_2), ...(O_N, p_N)$ for the N horses of a race.

A1.1 Expected utility model

The final state of endowment of a bettor wagering on horse i can either be $M - a$ if the horse loses the race or $M + aO_i$ if the horse finishes first. The former occurs with a probability of $1 - p_i$ and the latter with a probability of p_i. The overall value of a bet on horse i is hence $W(p_i, a, M, O_i) = p_i * u(M + aO_i) + (1 - p_i) * u(M - a)$, where u is a continuous and strictly increasing utility function such that $u(0) = 0$.

A1.2 Rank-dependent utility model

In the rank-dependent utility model (Quiggin [1982]), the overall value of a prospect with two possible outcomes equals the utility derived from the worst outcome, which the decision maker is sure to get, plus the possible increase in utility from obtaining the best outcome, weighted by the weighted probability of obtaining the best outcome.

The overall value of a bet on horse i is hence $W(p_i, a, M, O_i) = \varphi(p_i) * u(M + aO_i) + (1 - \varphi(p_i)) * u(M - a)$, where φ is the probability weighting function, continuous and strictly increasing from $[0, 1]$ to $[0, 1]$ and satisfying $\varphi(0) = 0$ and $\varphi(1) = 1$.

A1.3 Cumulative prospect theory model

The cumulative prospect theory model developed by Tversky and Kahneman [1992] departs from the rank-dependent utility model in that outcomes are perceived as

gains and losses with respect to a reference point. Additionally, the value function differs for gains and for losses. It is generally concave for gains and convex for losses; and steeper for losses than for gains to reflect loss aversion.

The probability weighting function overweights small probabilities and underweights moderate and high probabilities. It is inverse S-shaped, meaning concave then convex. The more curved it is, the more sensitivity to small probability changes near the extreme of the probability scale. This property is called diminishing sensitivity. The point where the function intersects the diagonal lies at a probability level of approximately 1/3.

A winning bettor obtains aO_i. This happens with probability p_i. Losses amount to a and occur with probability $1 - p_i$. The probability weighting function of gains is written φ^+ and that of losses φ^-. Both functions are strictly continuous and increasing from the unit interval into itself and satisfy $\varphi^+(0) = \varphi^-(0) = 0$ and $\varphi^+(1) = \varphi^-(1) = 1$. The overall value of a bet on horse i is $W(p_i, a, O_i) = \varphi^+(p_i) * u(aO_i) + \varphi^-(1 - p_i) * u(-a)$.

Note that utility is the same for gains and losses. The reason is that a is not observed so I do not have enough data to identify u in the domain of losses. Hence loss aversion is not modelled here. Note also that the reference point is the *status quo* which corresponds to not betting. Two key aspects of cumulative prospect theory are hence modelled here: reference-dependence and different probability weighting of gains and losses.

A2 Obtaining p_1 to estimate the parameters of the models

A2.1 Expected utility model

Let a be the amount bet by the representative bettor, M her initial wealth, O_i the odds associated to horse i, p_i the probability of winning of horse i and w a constant. I also define u, a continuous and strictly increasing utility function such

that $u(0) = 0$.

In equilibrium, $\forall i \in 1, ..., N,\ p_i * u(M + aO_i) + (1 - p_i) * u(M - a) = w$.

So that:

$$p_i = \frac{w - u(M - a)}{u(M + aO_i) - (M - a)} \tag{3}$$

Because $\sum_{i=1}^{N} p_i = 1$,

$$w = u(M - a) + \frac{1}{\sum_{j=1}^{N} \frac{1}{u(M+aO_j)-u(M-a)}} \tag{4}$$

Combining equations 3 and 4 solves the model for p_i:

$$p_i = \frac{1}{u(M + aO_i) - u(M - a)} * \frac{1}{\sum_{j=1}^{N} \frac{1}{u(M+aO_j)-u(M-a)}} \tag{5}$$

Given equation 5 and the shape of u,

$$p_i = \frac{1}{e^{a\theta} - e^{-a\theta O_i}} * \frac{1}{\sum_{j=1}^{N} \frac{1}{e^{a\theta} - e^{-a\theta O_j}}} \tag{6}$$

Note that a, which is not observed in the data, cannot be disentangled from θ.

A2.2 Rank-dependent utility model

Let a be the amount bet by the representative bettor, M her initial wealth, O_i the odds associated to horse i, p_i the probability of winning of horse i and w a constant. I also define u, a continuous and strictly increasing utility function such that $u(0) = 0$ and φ a probability weighting function, continuous and strictly increasing from $[0, 1]$ to $[0, 1]$ and satisfying $\varphi(0) = 0$ and $\varphi(1) = 1$.

In equilibrium $\forall i \in 1, ..., N,\ \varphi(p_i) * u(M + aO_i) + (1 - \varphi(p_i)) * u(M - a) = w.$

So that:

$$\varphi(p_i)=\frac{w - u(M - a)}{u(M + aO_i) - (M - a)} \tag{7}$$

Writing Ψ the reciprocal function of φ (which exists since φ is strictly increasing):

$$p_i = \Psi(\frac{w - u(M - a)}{u(M + aO_i) - u(M - a)}) \tag{8}$$

Because $\sum_{i=1}^{N} p_i = 1$:

$$\sum_{j=1}^{N} \Psi(\frac{w - u(M - a)}{u(M + aO_j) - u(M - a)}) = 1 \tag{9}$$

Solving this equation, which cannot be done analytically, gives w. Replacing w in equation 8 solves the model for p_i.

A2.3 Cumulative prospect theory

Let a be the amount bet by the representative bettor, O_i the odds associated to horse i and p_i the probability of winning of horse i. I also define u, a continuous and strictly increasing utility function such that $u(0) = 0$ and write φ^+ the probability weighting function of gains and φ^- that of losses. Both probability weighting functions are strictly continuous and increasing from the unit interval into itself and satisfy $\varphi^+(0) = \varphi^-(0) = 0$ and $\varphi^+(1) = \varphi^-(1) = 1$.

In equilibrium,

$$\forall i \in 1, ..., N,\ \varphi^+(p_i) * u(aO_i) + \varphi^-(1 - p_i)) * u(-a) = w. \tag{10}$$

Using the fact that $\sum_{i=1}^{N} p_i = 1$ and combining it with equation 10 solves the model for p_i. It can not be done in a closed form so that p_1 is obtained numerically.

A3 Details on probability weighting functions by model

A3.1 Rank-dependent utility model

Power probability weighting function

The probability weighting function has the shape:

$$\varphi(p) = p^{\alpha}$$

where $\alpha \geq 0$. If the weighted probability of winning the bet is inferior to the real probability ($\alpha > 1$), bettors underestimate the overall value of a bet, they are pessimistic. The expected utility model is equivalent to this model for $\alpha = 1$.

Cicchetti and Dubin probability weighting function

The function introduced by Cicchetti and Dubin [1994] is:

$$\frac{\varphi(p)}{1-\varphi(p)} = (\frac{p}{1-p})^{a_1} * (\frac{p_0}{1-p_0})^{1-a_1}$$

$\varphi(p)$ crosses the diagonal in p_0. a_1 is positive. If $a_1 < 1$, the function is convex, then concave. Inversely, if $a_1 > 1$, it is first concave, then convex. The closer a_1 is to 1, the closer to the diagonal the function is, which means relatively little sensitivity to small probabilities changes near the extreme of the probability scale and high sensitivity far off the extremes of the probability scale. When $a_1 = 1$, we are back to the expected utility model and p_0 is not identified.

This function is strictly increasing, its inverse is :

$$\Psi(p) = \frac{(\frac{p}{(1-p)*A})^{1/a_1}}{1 + (\frac{p}{(1-p)*A})^{1/a_1}} \text{ with } A = (\frac{p_0}{(1-p_0)})^{1-a_1}$$

Lattimore, Baker and Witte probability weighting function

The function proposed by Lattimore et al. [1992] is:

$$\varphi(p) = \frac{\delta p^\gamma}{\delta p^\gamma + (1-p)^\gamma}$$

where δ and γ are strictly positive. δ primarily controls the elevation of the function. It captures the extent of pessimism or optimism. γ primarily controls curvature (i.e., sensitivity to changes in probabilities). When $\delta = 1$ and $\gamma = 1$, we are back to the expected utility model. This function is strictly increasing, its inverse Ψ is:

$$\Psi(p) = \frac{(\frac{p}{\delta(1-p)})^{1/\gamma}}{1 + (\frac{p}{\delta(1-p)})^{1/\gamma}}$$

Prelec probability weighting function

The probability weighting function proposed by Prelec [1998] is:

$$\varphi(p) = e^{-\beta(-\ln p)^\alpha}$$

where $0 < \alpha \leqslant 1$ and $\beta > 0$. When $\beta = 1$ and $\alpha = 1$, we are back to expected utility. It is equivalent to the power specification for $\alpha = 1$. α represents the sensitivity to probabilities: the smaller it is, the more curved the function. $\beta < 1$ shows optimism, $\beta > 1$ pessimism. β hence controls the elevation of the function.

This function is strictly increasing, I write its inverse Ψ.

$$\Psi(p) = \exp(-(-\frac{\ln p}{\beta})^{(1/\alpha)})$$

Tversky and Kahneman probability weighting function

The probability weighting function of Tversky and Kahneman [1992] is:

$$\varphi(p) = \frac{p^\gamma}{[p^\gamma + (1-p)^\gamma]^{1/\gamma}}$$

When $\gamma = 1$, we are back to the expected utility hypothesis.

A3.2 Cumulative prospect theory

Power probability weighting functions

Probability weighting functions have the following shapes:

$$\varphi^+(p) = p^\alpha, \varphi^-(p) = p^\beta$$

When $\alpha = 1$ and $\beta = 1$, we are back to the expected utility hypothesis, except that utility applies to gains and losses rather than to final wealth. Since M cancels out in the expected utility model, it is nested within this model.

Cicchetti and Dubin probability weighting functions

Assuming that the probability weighting functions have the following shapes:

$$\frac{\varphi^+(p)}{1-\varphi^+(p)} = (\frac{p}{1-p})^{a_1} * (\frac{p_0}{1-p_0})^{1-a_1}$$

$$\frac{\varphi^-(p)}{1-\varphi^-(p)} = (\frac{p}{1-p})^{a'_1} * (\frac{p'_0}{1-p'_0})^{1-a'_1}$$

These functions cross the diagonal in p_0 and p'_0. a_1 and a'_1 are positive. When $a_1 = a'_1 = 1$, we are back to the expected utility hypothesis. $a_1 = a'_1$ and $p_0 + p'_0 = 1$ is equivalent to rank-dependent utility with the Cicchetti and Dubin probability weighting function. The reflection case occurs when $a_1 = a'_1$ and $p_0 = p'_0$.

Lattimore, Baker, Witte probability weighting functions

Assuming that the probability weighting functions have the following shapes:

$$\varphi^+(p) = \frac{\delta p^\gamma}{\delta p^\gamma + (1-p)^\gamma}$$

$$\varphi^-(p) = \frac{\delta' p^{\gamma'}}{\delta' p^{\gamma'} + (1-p)^{\gamma'}}$$

where δ, γ, δ' and γ' are strictly positive. When $\delta = \gamma = \delta' = \gamma' = 1$, we are back to the expected utility hypothesis. The reflection case occurs when $\delta = \delta'$ and $\gamma = \gamma'$.

Prelec probability weighting functions

Assuming that the probability weighting functions have the following shapes:

$$\varphi^+(p) = e^{-\beta(-\ln p)^\alpha}$$

$$\varphi^-(p) = e^{-\beta'(-\ln p)^{\alpha'}}$$

where $0 < \alpha \leqslant 1$, $\beta > 0$, $0 < \alpha' \leqslant 1$ and $\beta' > 0$. When $\beta = \alpha = \beta' = \alpha' = 1$, we are

back to expected utility. It is equivalent to the power specification for $\alpha = \alpha' = 1$. The reflection case occurs when $\alpha = \alpha'$ and $\beta = \beta'$.

Tversky and Kahneman probability weighting functions

Assuming that the probability weighting functions have the following shapes:

$$\varphi^{+}(p) = \frac{p^{\gamma}}{[p^{\gamma} + (1-p)^{\gamma}]^{1/\gamma}}$$

$$\varphi^{-}(p) = \frac{p^{\gamma'}}{[p^{\gamma'} + (1-p)^{\gamma'}]^{1/\gamma'}}$$

γ and γ' are positive. When $\gamma = \gamma' = 1$, we are back to the expected utility hypothesis. The reflection case occurs when $\gamma = \gamma'$.

CHAPTER 2

Merger Efficiency Gains: An Assessment of the French Urban Transport Industry*

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Abstract

This chapter provides an ex post evaluation of the merger that took place between Veolia Transport and Transdev in the French urban public transport industry in 2011, focusing on the existence and possible extent of efficiency gains, which are often overlooked in merger evaluation studies. We apply a difference-in-differences methodology to evaluate the effect of the merger on operating costs of transport operators. Our results show that the merger did not lead to any decrease in operating costs for the merging parties. Our study relies on the use of several control groups. It is robust to a great number of robustness checks as well as to the introduction of heterogeneous treatment effects, depending on the identity of the merging party, the contract type in place and the closeness of competition of local operators. A convincing explanation is that the merger proved to be problematic to implement because the choice of Veolia Transport was made too hastily, the two companies had very different cultures, clients and employees were reluctant to the merger and the merger was not well prepared. While we cannot generalize our results, we contribute to a growing number of case studies undertaken by economists which can help determining whether horizontal merger policy is being properly enforced and is efficient. Our findings also highlight the importance of the context (culture, choice of the target, perception by clients and employees, operational preparation of the merger, etc.) on the realization of efficiency gains, a determinant that is not given much weight in analyses by economists.

Key words: Ex post merger evaluation, Difference-in-differences, Merger cost efficiencies.

JEL classification: C31, L40, L50, L92.

2.1 Introduction

Huge merger activity observed in the last decades and speculations about the effectiveness of competition enforcement in this regard gave rise to a growing interest in retrospective analyses of mergers. While there exists a substantial number of studies estimating the price effects of large and/or controversial mergers, there exists little evidence on the effects of mergers on cost efficiencies. At the same time, efficiency gains are often one of the main arguments of merging parties in front of competition authorities and constitute in theory a central aspect to the economic motivation behind mergers. They constitute the primary justification as for why mergers of competitors may benefit consumers. Not surprisingly, one of the *"most important finding"* of the report of Ormosi et al. [2015] providing a review of merger decisions in the European Union is that "[...] *there is very little information on how dynamic factors, such as innovation and efficiencies, developed after a merger*".

The objective of this study is to assess whether a merger between two major transport groups gave rise to efficiency gains. We do this by studying the effects on the operating costs of local urban public transport operators of a large merger which took place between two of the three leading urban transport groups in France. In 2009, Transdev selected Veolia Transport to merge. This merger was approved by the French Competition Authority in 2010 with remedies and the deal was closed in 2011. The new entity, which faced one main competitor and three smaller competitors in the market, had a market share of nearly 40%. While the French Competition Authority mostly focused on potential anticompetitive effects of the merger, the main concern being the reduction in the number of competitors in competitive tenders, the notifying parties argued that the transaction would generate specific efficiency gains. These were claimed to be linked, on the one hand, to the achievement of cost savings in the operation of the networks and, on the other hand, to the possibility of providing a more extensive service offering thanks to the pooling of experience between the parties.

In France, the urban public transport sector is regulated by local authorities (cities or groups of cities) which are in charge of its organization at the local level. In the majority of networks they choose to delegate this task to a private/public-private

operator. Most operators belong to major transport groups. To select a transport operator, the local authority is required to launch a competitive tender procedure in which it specifies the characteristics of the service to be provided (network length, ticket fares, etc.). One of the main choice criterion in the tenders is the level of subsidies asked by the operator to operate the service. Efficiency gains can hence be a powerful means for operators in order to succeed in tenders. At the same time, efficiency gains, if reflected in lower subsidies paid to transport operators, relax the burden on taxpayers. This is of interest in a sector which is highly subsidized, commercial revenues covering only 30% of the cost of operating the service.

We study whether efficiency gains did actually materialize by performing an ex post evaluation of the merger focusing on its effect on operating costs of local operators belonging to the merging transport groups. Our analysis of efficiency gains is based on a unique and detailed database which provides information on the characteristics of urban transport networks, as well as detailed costs and revenues of urban transport operators in France over the 2006-2014 period, that is before and after the merger. This data was further complemented by a database of competitive tenders for the choice of transport operators which took place over the 2004-2014 period. In particular, it contains the identities of the incumbent operator, of the winner of the tender as well as of other operators that submitted offers in the competitive procedure. This database enables us to construct various control groups, using information on the intensity of competition in networks.

We employ a difference-in-differences methodology to study the potential efficiency gains resulting from the merger by comparing the evolutions of operating costs of networks operated by the merged companies with those of networks operated by competing companies. The main analysis presented in the chapter is undertaken on a balanced panel of transport networks which have not experienced a change of transport operator over the period of the analysis. The use of this voluntarily restrictive dataset enables us to have networks that remain either in the control or the treatment group over the whole period studied and to observe costs for each year and for each network included in the sample. We then perform a robustness analysis on an unbalanced sample of networks.

Finding a suitable control group to estimate the causal effects of mergers can be a

great challenge in many industries (see for instance the discussion made by Nevo and Whinston [2010]). The characteristics of our industry do seem to suggest a good field for applying the methodology, as we can easily exploit variations in the conditions across local networks. We consider several control groups in order to control for the possibility that the networks operated by competitors of the merging parties have reacted to the merger. We believe that spill-over effects may be an issue only if competitors of the merging parties expected the merging party to become more aggressive in competitive tenders following the realization of merger efficiency gains. They could have reacted strategically by improving their bids in competitive tenders and subsequently decreasing operating costs. Hence the reaction of competitors of the merging parties, if any, is likely to concern contracts signed after the merger. For this reason, the first control group is composed of all networks managed by the three main competitors of Veolia Transport and Transdev, namely CarPostal, Keolis and RATP Développement and the second control group accounts for this possible strategic reaction of competitors post merger by including only networks for which the contract for the operation of the urban transport service in a given network was signed prior to the merger.

To identify more precisely the impact of the merger on the costs of transport operators, we further explore heterogeneity in the cost effects by exploiting the richness of our data. Firstly, we examine whether the effect of the merger differs between the networks operated by the respective merging groups, Veolia Transport and Transdev. Secondly, we explore whether effects on costs differ depending on the type of regulatory contract type in place (fixed-price or cost-plus). Finally, we also consider the effects of the merger, depending on whether the merging parties were direct local competitors prior to the merger, defined as having networks in the same or neighboring counties (French *département*). We also introduce specifications, in which we remove the years between the announcement of the merger and the closing of the deal as this event window may suffer from contamination of the data around the time of the merger.

In the robustness analysis on the unbalanced panel, we are able to test one more restrictive control group, which is composed only of networks where there seems to be no competition from Veolia or Transdev during public tenders. This control group is composed only of networks in which Veolia Transport and Transdev did

not submit a bid in tenders for the operation of the transport service throughout the period of our analysis.

In all specifications, our results show that the merger did not lead to efficiency gains for the merging parties. Our explanation is that the choice of Veolia was made too hastily, the merger was poorly prepared and the differences in cultures between the two groups made both clients and employees reluctant to the merger. These explanations are highly specific to the case at hand. We cannot hence conclude from our results that a change of market structure in the sector of urban transport cannot lead to efficiency gains. Additionally, the role played by the context of the transaction (culture, choice of the target, perception by clients and employees, operational preparation of the merger, etc.) in the lack of materialization of efficiency gains questions whether this aspect should be given more weight by economists in their models and by the Competition Authority in its analysis of potential effects of mergers.

The ability to generalize our results and comment on the European horizontal merger policy is clearly limited. However, we contribute to a growing number of case studies undertaken by economists which can help determining whether horizontal merger policy is being properly enforced. Most such studies concentrate on impacts of horizontal mergers on prices. A sheer amount of empirical research directly estimates the effects of large and/or controversial mergers by employing a difference-in-differences methodology. In particular, many recent studies exploit growing availability of data and features of the retailing sector to assess large mergers in Europe (e.g. Aguzzoni et al. [2014]; Aguzzoni et al. [2016]; Allain et al. [2017]) and in the U.S. (e.g. Ashenfelter and Hosken [2010]; Ashenfelter et al. [2013]; Ashenfelter et al. [2015]). Earlier work applying a similar methodology focused on mergers in major industries, such as airline markets (Borenstein [1990]; Kim and Singal [1993]), banking (Focarelli and Panetta [2003]) and petroleum (Hastings [2004]; Gilbert and Hastings [2005]). Also, a small recent literature studies the actual effects of mergers with the aim to assess the validity of predictions of merger simulation models (see for instance Peters [2006]; Weinberg [2011]; Weinberg and Hosken [2013]; Friberg and Romahn [2015]; Björnerstedt and Verboven [2016]).

Despite a growing number of studies analyzing the price effect of mergers in a vari-

ety of industries, still little work exists on the ex post evaluation of merger-specific efficiency gains. To our knowledge, few studies covering a limited number of sectors exist that evaluate cost efficiencies from mergers directly. Brito et al. [2013] evaluates the impact of mergers in non-life insurance markets in Portugal through their effect on exercising of market power through coordinated effects and firms' internal efficiency. Its analysis relies on the specification and estimation of a structural model including preferences, technology and a market equilibrium condition. It shows that following the mergers, there is no evidence either of an increase in market power through coordinated behavior or of changes in cost efficiency levels. Kwoka and Pollitt [2010] studies the impact of the merger wave which took place in the U.S. electricity industry by analyzing its impact on operating and total costs in electricity distribution. It employs data envelopment analysis to assess efficiency effects of mergers and concludes on the basis of its results that electricity mergers are not consistent with improved cost performance. Dranove and Lindrooth [2003] examines hospital consolidation in the U.S. by focusing on its effect on hospital costs. Cost function estimates of hospitals undergoing consolidation are compared to *"pseudo-merger"* hospitals chosen based on propensity scores. The empirical strategy is based on the assessment of whether the cost functions of actual mergers are lower than those of pseudo-mergers. It shows that mergers consisting in consolidation of financial reporting and licenses generated cost savings in the 2-4 years following the mergers. Clearly, more retrospective studies are needed to help evaluating the effects of mergers on efficiency gains.

The chapter is organized as follows. Section 2.2 presents the French urban public transport industry. Section 2.3 describes the merger under study. Section 2.4 presents our empirical strategy, main empirical analysis, findings and robustness checks. Section 3.7 discusses the results and section 3.8 concludes.

2.2 The French urban public transport industry

2.2.1 Organizational background

The general principles of the organization of urban public transport in France date back to the Transport Law of 1982[1]. It provides a guideline for the organization of public passenger transportation in urban transport areas and establishes the concept of economic and social efficiency by declaring the right to affordable public transport. The public authority, consisting of cities or group of cities, is responsible for the organization of urban public transport in that it has to define, finance and organize it[2]. There exists no national regulator of the sector and transportation is regulated by local authorities. The relevant public authority is left with the choice to organize and provide the service itself or to delegate the relevant responsibilities to a fully private or public-private operator.

Currently, there are approximately 300 transport networks in France and nearly 90% of them are operated through delegated management (GART [2015]). In delegated management, the local authority chooses an operator to which it entrusts the operation of the service. The key feature of the French model is that the operation of the network is attributed to only one operator which carries the responsibility of providing the relevant service in the whole urban transport area (see Yvrande-Billon [2006]). The relationship between the operator and the local authority is regulated through a contract in which the local authority specifies the characteristics of the service (ticket fares, number of stops, routes, frequency, output, schedule, quality of service, conditions for subsidizing the service, level of investment, ownership structure, obligations of operators to passengers, etc.) as well as the reimbursement scheme. In most networks, investment in the infrastructure remains the responsibility of the organizing authority and the local authority owns the rolling stock and infrastructure, which are put at the disposal of the operator. To illustrate, in 2013, 78% of the rolling stock belonged to organizing authorities (GART [2015]).

[1] Loi 82-1153 du 30 décembre 1982 d'orientation des transports intérieurs.

[2] As opposed to the rest of France, the region of Paris (Ile-de-France) has only one authority responsible for organizing urban public transport. It takes its decisions in consultation with dedicated transport carriers (RATP, SNCF and OPTILE).

Operating costs are hence the relevant measure of long-term efficiency in the specific context of urban transport because operators do not incur capital costs, they only operate the networks.

Until 1993, the automatic renewal of contracts was a common practice (see Gagnepain and Ivaldi [2002]). The Sapin Law[3] made competitive bidding compulsory before awarding a contract for the provision of a public service. The aim of the law was to prevent collusion and corruption and enhance competition between the operators in the industry. It did not, however, forbid the use of negotiation in the procedure. As a result, operators are selected in a two-step procedure, i.e. a pre-selection step with the use of competitive bidding and a negotiation phase which allows for subjective selection criteria.

2.2.2 Transport groups and competition in the industry

Before the merger, nearly 70% of the operators were subsidiaries of three major groups, two of which being private and one semi-public: Keolis, Veolia Transport and Transdev. In 2009 (prior to the merger), Keolis was owned by the French National Railway Company SNCF. Veolia Transport was then a subsidiary of the French group Veolia Environment[4] and Transdev was owned in majority (69.6%) by the French public financial institution Caisse des Dépôt et Consignations (hereafter CDC). In addition, three smaller players were already present in the market at that time (RATP Développement, Vectalia France and Carpostal). RATP Développement (hereafter RATP Dev), owned by RATP[5], was created in 2002. Our interviews with local operators suggest that RATP Dev has recently become an important player in the industry especially in small and middle-sized networks. In addition, two foreign groups were present in the market: Vectalia France and CarPostal France. Vectalia France is a subsidiary of the Spanish group Subus and is present in France since 1998. CarPostal France is a subsidiary of the Swiss Group CarPostal Suisse and it operates in France since 2004. The extent of the presence of Vectalia and CarPostal in France was mainly limited to transport areas close to the

[3]Loi 93-122 du 29 janvier 1993 relative à la prévention de la corruption et à la transparence de la vie économique et des procédures publiques.

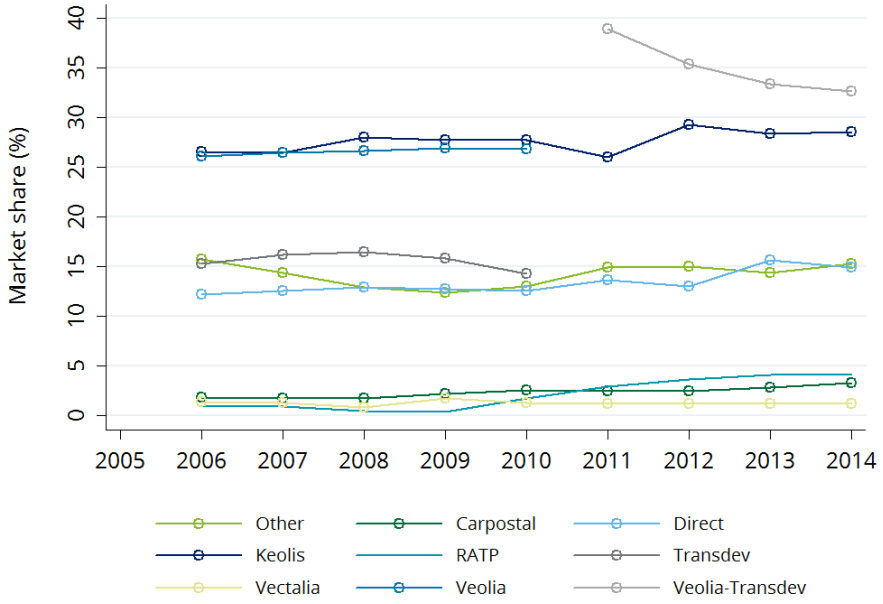
[4]Veolia Environnement is a French group with global activities in water provision, water sanitation, waste treatment, cleaning and sanitation services, energy services and transport.

[5]RATP is the operator of urban transport in Paris. It is a public company.

relevant borders. The remaining operators were independent or belonged to local and regional transport groups.

Market shares measured by the number of networks of the respective groups are presented in figure 2.1. Prior to the merger in 2011, the leading transport group was Keolis (with a market share of nearly 30%), followed by Veolia Transport (26%) and Transdev (16%).

Figure 2.1: Market shares (in number of networks)



2.2.3 Financial situation

Urban public transport in France is highly subsidized. Operators face public service obligations and are obliged to operate in low-density areas. Low prices are maintained in order to provide accessible transport to all consumers of urban transportation as well as to attract new consumers. While the industry has seen a significant increase in the supply and quality of transport, this is not accompanied by a sufficiently strong demand for the service or by higher ticket fares. The strong social objective of the public policy of urban transport translates into pricing choices that are disconnected not only from total costs, but also from operating costs. As a result, the industry is currently facing strong financial constraints. The ratio of commercial receipts to operating costs has been deteriorating over the years. Com-

mercial receipts currently cover, on average, hardly 30% of operating costs (Cour des Comptes [2015]). The remaining operating costs are covered by subsidies from the State, local authorities and a special transport tax paid by local firms[6]. Potential merger efficiency gains are of interest in such a highly subsidized industry.

2.3 The merger

2.3.1 The story

In 2002, the majority owner of Transdev (CDC) and RATP concluded a strategic partnership. RATP became a shareholder of Transdev with approximately 26% of its shares. However, in 2009, both Transdev and RATP were not satisfied with this partnership. RATP was interested in either developing its activities in urban public transport outside of the Paris region through its subsidiary RATP Dev or in taking control of Transdev. CDC, on the other hand, wanted to remain the main shareholder of Transdev.

CDC, which is a public financial institution, started looking for a new partner for its subsidiary Transdev. Its goal, as declared publicly, was to avoid that four powerful French transport groups compete for contracts outside of France. CDC indeed expected it to be detrimental to the success of the French transport industry and so it decided to create one large group which had the potential to win contracts abroad. The new entity was expected to be one of the biggest transport companies in the world and to be taken public within two years after the merger. Veolia Transport and Keolis both expressed their interest in merging with Transdev in the spring of 2009.

Near the end of July 2009, Trandev disclosed its preference for Veolia Transport. The operation was first notified to the European Commission. On August 12, 2010, the European Commission referred to the French Competition Authority for an examination of the French part of the concentration. The merger was authorized

[6]This transport tax consists of a local contribution of employers that allows to provide additional funding for urban public transport. It is imposed on employers of both the public and private sector that employ more than 9 full-time employees within an urban transport area of a population of more than 10,000. It is collected by each urban transport area.

with remedies by the French Competition Authority in December 2010[7] and the final closing of the operation occurred on March 3, 2011.

As in the case of most mergers, the merger between Veolia Transport and Transdev is associated with potential anticompetitive and pro competitive effects. On the one hand, the merger resulted in a decrease in the number of players in the industry and potentially in the number of bidders in the relevant tenders, which could have fostered anticompetitive effects. On the other hand, the merger may have resulted in efficiency gains in the form of a decrease in costs. If these cost efficiencies were passed on to local authorities in the form of more attractive bids in tenders, the merger would have possibly benefited consumers.

2.3.2 Competition concerns of the French Competition Authority

As certain competition concerns arose during the analysis of the merger by the French Competition Authority, it was approved subject to several commitments taken by the merging parties. In particular, the French Competition Authority considered that the merger raised competition concerns in the urban transport market which we analyze.

The Competition Authority was concerned that the decrease in the number of candidates resulting from the merger could increase the prices of bids submitted in tenders and decrease the quality and diversity of offers. To identify the concerned networks and assess the intensity of competition, it performed a detailed study of past tenders and market shares. It argued that potential anticompetitive effects were a relevant threat for networks in which both groups would submit an offer (20-25% of tenders in 2009)[8]. These potential anticompetitive effects were particularly strong in the South of France in the Provence Alpes Côte d'Azur (hereafter PACA) region, where the presence of Veolia Transport and Transdev was most pronounced.

In order to address these concerns, the merging parties proposed to finance the creation of a competition stimulation fund in the amount of €6.54 million. This remedy

[7] Autorité de la concurrence, Décision 10-DCC-198 du 30 décembre 2010 relative à la création d'une entreprise commune par Veolia Environnement et la CDC.

[8] Autorité de la concurrence, Décision 13-DCC-137 du 1er octobre 2013 relative à la prise de contrôle exclusif de la société Transdev Group (ex-Veolia Transdev) par la Caisse des Dépôts et Consignations.

was introduced to compensate the expenses associated to responding to tenders for small candidates, in the case they were not selected, as well as to help local authorities organize the selection process. The purpose of the fund was to encourage small competitors to take part in tenders. The fund also aimed at helping small organizing authorities to improve their efficiency in the competitive bidding procedures. This fund was reserved for transport networks in which Veolia Transport and Transdev were the outgoing operators and that would be subject to open competition within five years of the merger realization date (forty-four tenders in total). In addition, to resolve the problems specific to the PACA region, the parties were obliged to sell their shares and assets in the operation of four urban transport networks located in the PACA region.

The relevant organizing authorities refused to authorize the divestiture of the contracts in all four networks concerned by the remedy. Hence, no divestitures occurred. The new entity was not, however, authorized to compete in the tenders for the renewal of these contracts[9]. To our knowledge, two of them were renewed in October 2013 and the new entity did not make an offer for these tenders. Concerning the competition stimulation fund, information on its use is not available publicly and hence we could not shed any light on its use.

Concerning efficiency gains, the Competition Authority explained in the decision that the merging parties argued that the merger would create substantial efficiency gains, in particular a reduction in operating costs. The Authority, without performing a detailed analysis of efficiency gains, considered that the occurrence of such efficiency gains was not credible enough to counterbalance potential anticompetitive effects from the merger. The Authority also argued that even if efficiency gains were to materialize as argued by the parties to the concentration, they would most likely not be passed on to taxpayers via a decrease in subsidies from local authorities to transport operators.

[9] Autorité de la concurrence, Décision 13-DCC-137 du 1er octobre 2013 relative à la prise de contrôle exclusif de la société Transdev Group (ex-Veolia Transdev) par la Caisse des Dépôts et Consignations, par.43.

2.3.3 Potential efficiency gains

As could be understood from reading the decision of the Competition Authority, efficiency gains were the key argument pushed forward by the merging parties to approve the merger. Indeed, the industry suggests several means by which joining two groups following a merger may give rise to cost efficiencies.

The characteristics of the industry are such that operators do have incentives to reduce operating costs. The incentive to reduce costs in this highly subsidized industry comes on the one hand from the pressure of competitors in competitive tenders and on the other hand from the type of contracts which are used by local authorities. The dominant contract types observed in France are fixed-price and cost-plus contracts. In networks regulated under fixed-price contracts, operators receive subsidies according to their expected operating deficits. Therefore, profits of operators suffer from cost overruns and lower-than-expected revenues. In networks regulated under cost-plus contracts, the organizing authority collects commercial receipts and fully reimburses the operator's operating costs, increased by a pre-defined additional amount which constitutes the margin of the operator. Under this regulatory scheme, the regulator provides the operator with subsidies to cover its actual deficits. Cost changes hence do not affect the operator's profits. In the past years, the industry has seen a move towards fixed-price contracts which are high-powered incentive schemes for operators. The proportion of networks that were regulated under a cost-plus contract has indeed decreased substantially, from 100% in the 1970s, 60% in the 1980s, 25% in the 1990s (Yvrande-Billon [2006]) to only 7% in 2013 (GART [2015]). Operators hence have incentives to decrease costs in order to increase their profits and to win contracts. We briefly present hereafter the potential sources of operating cost efficiencies in the case of the merger we analyze.

Operating costs reductions may come from knowledge sharing between local operators. Local operators are indeed likely to share knowledge at the group level on how to efficiently operate a network. Gagnepain and Aguiar [2013] uses an earlier version of our database (up to 2001) to show that an operator belonging to an industrial group benefits from the cost reducing activities of the remaining operators of the group because knowledge generated by a local operator may be processed by the

headquarters of the group and then transmitted to other networks operated by the group. They suggest that cost reducing activities may concern for instance R&D processes, the search for cheaper suppliers, experience in procurement contracts bargaining or methods in monitoring employees. A merger between two groups may have allowed methods, procedures and general knowledge of operators of one group to be passed on to operators belonging to the other. As an example, appropriate staff training may help in reducing delays and/or accidents and help fight against fraud. Knowledge sharing may also concern means of lowering maintenance costs by for example finding the right balance between prevention and maintenance.

Further, potential operating costs reductions may come from improved managerial efficiency. A change in the managerial policies and procedures imposed to local operators by the new group may have moved networks of the new entity closer to the best practice of the industry. As an example, better management may help in increasing staff productivity by reducing the rate of absenteeism. The merger may have changed the attitude of the management, motivating it and making it more efficient. Cost efficiencies may have resulted in a more stable management at the regional and national level. To our knowledge, management was very unstable in Veolia Transport prior to the merger. Regional and national managers changed very frequently. Since they are responsible for monitoring operating costs of local operators, a more stable managing team could help local operators to be more efficient.

Another source of potential operating costs reduction is a decrease in the costs of materials purchased for operating the networks such as gasoline or spare parts. By pooling the purchases of the two groups, the merger may have increased their bargaining power hence leading to better deals. Along the same line, the merger may have increased the power of the group in the labor market and hence helped negotiating lower wages, thereby decreasing wages costs.

Finally, the spread of the specific values and specificities of each group to the other may have reduced operating costs.

2.4 Merger evaluation

2.4.1 Empirical strategy

Our goal is to perform an ex post evaluation of the merger that took place between Veolia Transport and Transdev, by comparing the evolution of the operating costs of the merging companies before and after the merger to the evolution of a control group unaffected by the merger. We are interested in studying whether the merger resulted in cost efficiencies achieved by the new entity.

Ideally, we would like to compare actual post merger market outcomes of networks affected by the merger with market outcomes in these same networks in a world where the merger did not take place. This, for obvious reasons, is impossible. The econometric strategy seeks thus to construct a counterfactual group that reflects as closely as possible how market outcomes of networks affected by the merger would have evolved had the merger not occurred. The evolution of market outcomes of operators belonging to Veolia Transport or Transdev which were affected by the merger (treatment group) is then compared to the evolution of market outcomes of networks which were not affected by the merger (control group).

Our empirical investigation starts with a simple before-after estimation of the effect of the merger on operating costs of networks operated by Veolia Transport and Transdev. In the before-after estimation, the central assumption is that, conditional on covariates, operating costs of networks operated by Veolia Transport and Transdev would have remained the same had the merger not occurred. This assumption is strong, as unobserved factors may have affected the evolution of operating costs.

The following regression is estimated:

$$ln(C_{nt}) = \alpha_0 + \alpha_1 Post_t + \sum_i \gamma_i X_{int} + \delta_n + \beta trend_t + e_{nt}, \tag{2.1}$$

where C_{nt} represents operating costs of network n in year t, $Post_t$ is a dummy variable taking the value 1 post merger, X_{nt} is a vector of factors other than the merger affecting operating costs, $trend_t$ is a yearly time trend, δ_n is a network

specific fixed effect and e_{nt} is the error term. α_0, α_1, γ_i and β are the coefficients to be estimated. Our focus is put on the sign of α_1 which allows us to assess the existence (and possibly the extent) of efficiency gains coming from the merger. The regression includes a time trend, as operating costs seem to follow a steady increase over the years. Regressions both with and without networks fixed effects are considered.[10]

Our data then allows us to employ a difference-in-differences (hereafter DiD) approach to estimate the impact of the merger on operating costs of Veolia Transport and Transdev. The key assumption behind the use of this method is that outcomes (operating costs) in the treatment group and control group would have followed, conditional on covariates, parallel trends over time absent the treatment (merger). The ideal control group is such that the variable of interest evolves similarly as in the treatment group with the only difference that it did not experience the treatment. Another key assumption of the method is that the merger is exogenous. This assumption may be violated if omitted variables affect both the market outcome studied and the decision to merge. The model may also suffer from reverse causality between the market outcome and the merger. This is for example the case when an increase in operating costs triggers a merger in order to create cost savings.

We estimate the following equation:

$$ln(C_{nt}) = \alpha_0 + \alpha_1 Post_t + \alpha_2 Post_t * Treat_n + \sum_i \gamma_i X_{int} + \delta_n + e_{nt} \tag{2.2}$$

where C_{nt} represents the operating costs of network n in year t, $Post_t$ is a dummy variable taking the value 1 post merger, $Treat_n$ is a dummy variable taking the value one for networks belonging to the treatment group, X_{nt} is a vector of factors other than the merger affecting operating costs, δ_n is a network specific fixed effect and e_{nt} is the error term. α_2 is the coefficient of interest, it provides a measure of the effect of the merger on the operating costs of the merged entities.

The vector X_{nt} includes time-varying variables measured at the network level, which are likely to be a source of omitted variable bias if they are not controlled for, such

[10]The use of fixed effects implies that the effect of the merger is solely identified for networks for which we have data both before and after the merger.

as the number of seat-kilometers provided by the network. We estimate the effect of the merger with and without fixed effects[11]. We also estimate the effect of the merger using time dummies instead of the variable $Post_t$. In addition, we allow for heterogeneous merger effects to vary depending on whether the network was managed by Veolia Transport or Transdev prior to the merger, depending on the type of regulatory contract implemented (fixed-price or cost-plus) and whether the merging parties operate in the same geographical area. In all estimations, standard errors are clustered at the network level to account for serial correlation, as suggested by Bertrand et al. [2004].

The main analysis presented in the chapter is undertaken on a balanced panel of transport networks which have not seen a change of transport operator over the period of the analysis. The use of this voluntarily restrictive dataset enables us to have networks to remain either in the control or the treatment group over the whole period studied and to have an observation of costs for each year for each network. We then use an unbalanced panel in the robustness analysis. The unbalanced panel has the advantage to contain much more networks, allowing us to construct alternative control groups.

We define several control groups in order to control for the possibility that the networks operated by competitors of the merging parties reacted to the merger. We expect efficiency gains to mainly come from knowledge sharing between the merging companies, pooling of purchases of materials, common negotiation of wages or improved management, which are unlikely to spill-over to competitors. Spill-overs may, however, arise if competitors of the merging parties expected the latter to become more aggressive in competitive tenders because of the efficiency gains from the merger. In particular, competitors of Veolia and Transdev may have reacted strategically by improving their bids in competitive tenders and subsequently decreasing operating costs. Hence the reaction of the competitors of the merging parties is likely to concern contracts signed after the merger.

We gathered evidence from operators in the industry that CarPostal, Keolis and RATP Développement are similar with respect to their operating costs and respond

[11]When equation 2.2 is estimated without network fixed effects, we include a dummy for treatment that equals one for networks operated by Veolia Transport and Transdev and zero for networks included in the control group.

to cost shocks in the same way. Hence the first control group (C_1) is composed of all networks managed by the three main competitors of Veolia Transport and Transdev, namely CarPostal, Keolis and RATP Dev[12]. The second control group accounts for the possible strategic reaction of competitors post merger by including only networks in which the contract for the operation of the urban transport service in a given network was signed prior to the merger (C_2).

In the robustness analysis performed on the unbalanced panel, we are able to test one more restrictive control group, which is composed only of networks where there seems to be no competition from Veolia or Transdev during public tenders[13]. We believe that the operators of these networks are unlikely to react to the merger since they are not subject to competition neither from Veolia nor from Transdev. This control group (C_3) is composed only of networks in which Veolia Transport and Transdev did not submit a bid for tenders for the operation of the transport service throughout the period of our analysis. The definitions of the treatment and control groups are summarized in Table 2.1.

Table 2.1: Definitions of treatment and control groups

Group	Definition
Treatment group	Networks operated by Veolia Transport or Transdev.
Control group C1	Networks operated by Keolis, RATP Dev or CarPostal.
Control group C2	Networks operated by Keolis, RATP Dev or CarPostal. Contracts signed before the merger.
Control group C3	Networks operated by Keolis, RATP Dev or CarPostal. Networks in which Veolia Transport and Transdev did not submit a bid in tenders.

Our analysis covers the period 2006[14]-2014. In addition, we perform estimations excluding the years 2009 and 2010. This corresponds to the period between the announcement of Transdev wanting to merge and the merger itself. As this announcement may have affected the operating costs of Veolia Transport, Transdev or its rival groups, we perform additional estimations excluding this period.

[12]We have also considered Keolis separately. This does not change our results. For sake of clarity, we do not present the results of additional control groups considered.

[13]We also tested a control group consisting only of networks where competition in tenders seems to be absent, which is considered to happen in networks that did not see a change in operator since 2005 and in which only one offer was submitted in tenders which took place since 2004. The parallel trend assumption was not verified for this group, which was hence excluded from the analysis.

[14]We test several alternative time windows, starting at 2007 and 2008. This does not change our results and conclusions of the analysis remain the same.

2.4.2 Data and variables

Our study uses a 9-year panel of urban public transport networks in France for the years 2006-2014. The database has been created from an annual survey conducted by the Centre d'Études et d'Expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement (CEREMA) in collaboration with the Groupement des Autorités Responsables de Transport (GART) and the Union des Transports Publics et ferroviaires (UTP). The database contains details on the actors providing the service, the regulatory environment as well as costs and revenues of operators. For sake of homogeneity across observations, only bus networks serving more than 20,000 inhabitants in the territory of France have been selected for the analysis.

Studying the effects of the merger on operating costs requires data on the operating costs themselves, as well as factors, other than the merger, influencing them. Operating costs C are defined as the sum of labor costs and material costs. Output Y is measured by the number of seat-kilometers, i.e. the number of seats available in all buses multiplied by the number of kilometers traveled on all routes. We thus use a supply-oriented output variable. Labor price w_l is obtained by dividing labor costs by the annual number of employees employed directly by the operator[15]. Material price w_m is obtained by dividing material costs by the total number of vehicles operated by the operator (without including subcontracted vehicles). Since the local authority owns the rolling stock and infrastructure, which are put at the disposal of the operator, the operator does not incur capital costs.

Descriptive statistics of our database, which covers the period 2006-2014, are presented in Table 2.2. In the full sample, average operating costs amount to nearly €7M. The average input prices are approximately €38,000 per employee and €19,000 of materials per car per year. More than 200 million seat-kilometers are supplied yearly, on average.

We then compare mean values of our variables of interest in the periods prior to and following the merger in Table 2.3. A rapid look at the data suggests that, on average,

[15]Labor costs concern employees employed directly by the operator. Consequently, the number of employees does not include the employees of companies to which the operator outsources some activities. Employees of subcontracting companies represent between 6% and 9% of the total number of employees of the operator depending on the year considered.

Table 2.2: Statistics on the dataset – all observations

Variable Name	Mean	SD	Min	Max
Costs ('000 Euros)	6,714.3	6,965.2	873.7	38,435.6
Production ('000 seat–kilometers)	205,904.3	180,678.0	25,583.5	750,272.5
Wages ('000 Euros per employee)	38.2	4.2	26.9	53.0
Price of materials ('000 Euros per bus)	19.3	4.8	6.0	34.2

yearly costs have increased in the period following the merger. This is accompanied, however, by an increase in output over time, as suggested by the average number of seat-kilometers. Table 2.3 also suggests that prices of labor and material have slightly increased between the period before and after the merger.

Table 2.3: Statistics on the dataset – pre and post merger

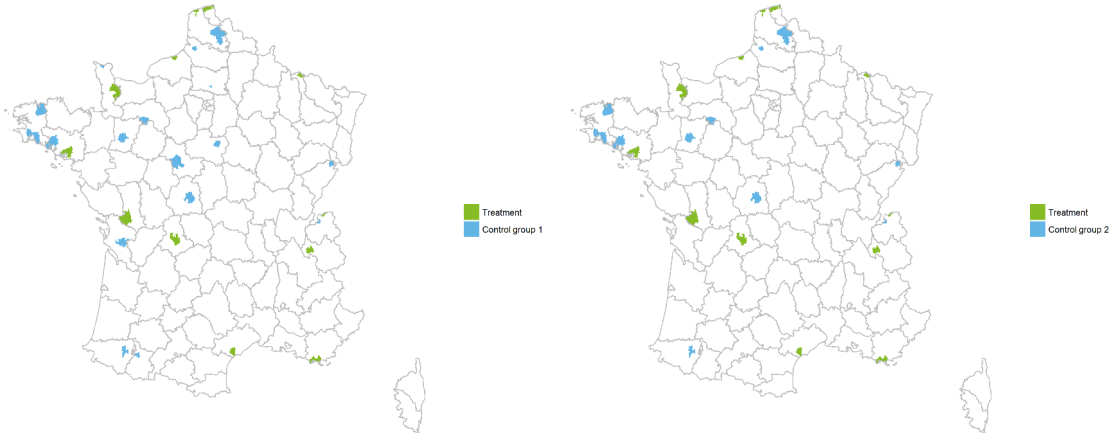
Variable Name	Mean	Mean pre–merger	Mean post–merger
Costs ('000 Euros)	6,714.3	6,161.9	7,404.9
Production ('000 seat–kilometers)	205,904.3	194,404.6	220,279.0
Wages ('000 Euros per employee)	38.2	37.4	39.2
Price of materials ('000 Euros per bus)	19.3	18.0	20.8

The main analysis presented in the chapter relies on a balanced sample of 45 transport networks that have not seen a change of operator over the years 2006-2014, a sample of 405 observations. Details on the number of observations in the respective treatment and control groups are presented in Table 2.4. Figure 2.2 provides a cartographic representation of the transport networks included in the balanced sample.

Table 2.4: Number of observations (networks) by group – pre and post merger (balanced panel)

Group	All	Pre–merger	Post–merger
Treatment group	117 (13)	65	52
Control group C1	171 (19)	95	76
Control group C2	117 (13)	65	52

Table 2.5 compares mean values for the treatment and control groups. We find that on average, the treatment group contains bigger networks and hence faces higher operating costs than the control groups. Wages and prices of materials remain comparable between the treatment and control groups.



(a) Control group – C1 (b) Control group – C2

Figure 2.2: Map of transport network included in the treatment and respective control groups – balanced panel

Table 2.5: Statistics on the dataset – treatment and control groups

Variable Name	Mean T	Mean C1	Mean C2
Costs ('000 Euros)	8,465.0	5,516.5	6,466.5
Production ('000 seat–kilometers)	235,028.7	185,977.1	217,285.5
Wages ('000 Euros per employee)	38.7	37.9	38.6
Price of materials ('000 Euros per bus)	19.6	19.0	19.2

In the robustness part of the chapter, we extend the analysis by exploiting the full sample, that includes networks which have witnessed a change of operator during the period of the analysis and networks with missing values of costs or other relevant variables included in our specifications. Using this unbalanced panel bears the advantage of having a sample with many more networks. This allows us to introduce one additional control group ($C3$). Note that the construction of this group involves exploiting the database on tenders[16]. The frequencies of our treatment and each of our pre- and post merger control groups are presented in Table 2.6. As shown in Figure 2.3, our additional analysis relies on a larger number of transport networks, dispersed geographically across the country.

Table 2.6: Number of observations (networks) by group – pre and post merger (unbalanced)

Group	All	Pre–merger	Post–merger
Treatment group	467 (67)	276 (64)	191 (54)
Control group C1	473 (69)	252 (59)	221 (60)
Control group C2	393 (60)	246 (58)	147 (48)
Control group C3	140 (17)	84 (17)	56 (15)

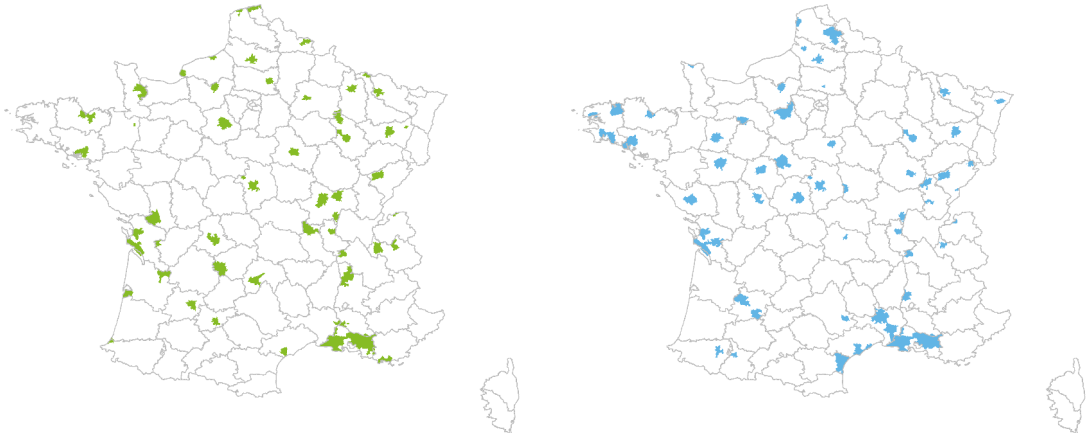
2.4.3 Main analysis

Identification

The key identifying assumption of the DiD estimation method is that had the treatment not been implemented, operating costs of the treatment group and control group would have followed, conditional on the control variables included in the regression, the same evolution. Figure 2.4 represents the evolution of operating costs of the treatment and control groups over time[17]. It shows clearly that they follow parallel trends prior to the merger. We also note that these parallels trend were not interrupted by the merger.

[16]We use an original database gathering tenders for the choice of a transport operator which took place in the years 2004-2013. This information was obtained from press releases, as well as from representatives of organizing authorities. The dataset includes the identity of the transport operators that submitted bids in the tender, the identity of the incumbent transport operator, as well as the identity of the winner of the competitive bidding procedure.

[17]The difference in levels of costs between the treatment and control groups can be fully explained by the observable characteristics of the networks that we control for in the regressions, namely the number of seat-kilometers and input prices.



(a) Treatment

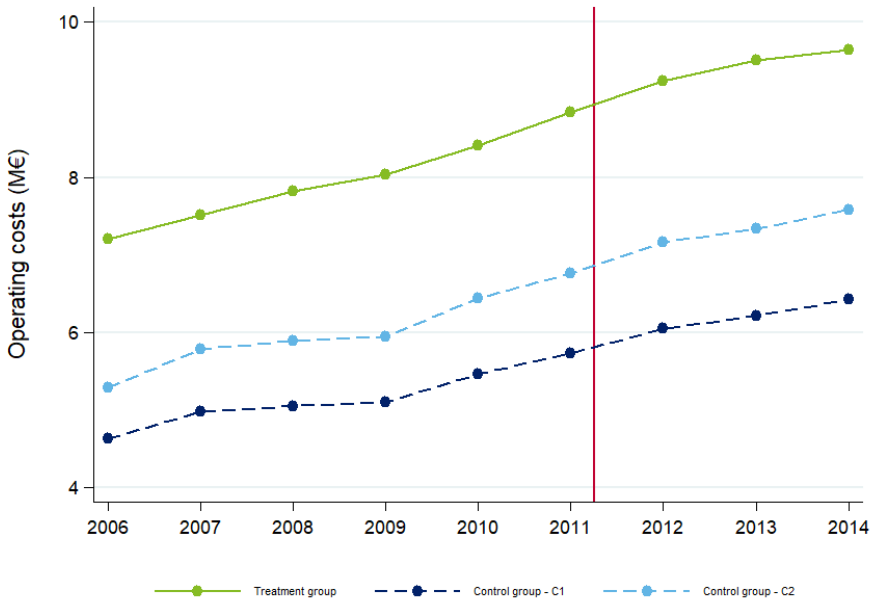
(b) Control group – C1

(c) Control group – C2

(d) Control group – C3

Figure 2.3: Map of transport network included in the treatment and respective control groups – unbalanced panel

Figure 2.4: Evolution of costs – treatment and control groups

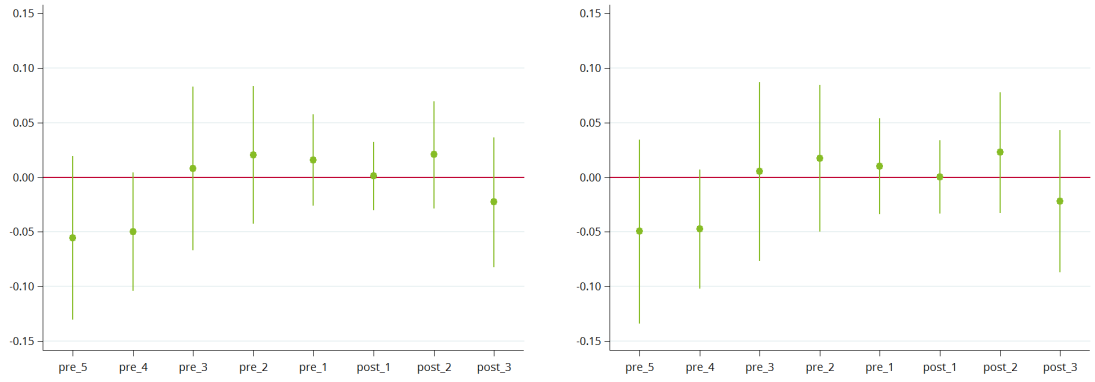


We further verify the satisfaction of the parallel trends assumption running a placebo test, as suggested by Autor [2003]. It consists in introducing placebo treatments in the equation of interest in all years except one. The following equation is estimated:

$$ln(C_{nt}) = \alpha_0 + \eta_t + \sum_{j \neq 2010} \beta j(Treat_n * I(t = j)) + \sum_i \gamma_i X_{int} + \delta_n + e_{nt} \qquad (2.3)$$

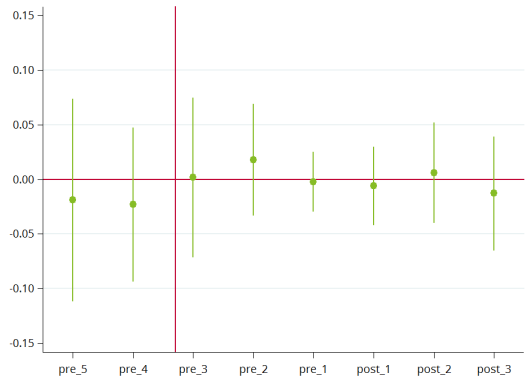
where C_{nt} represents operating costs of network n in year t, η_t are time-specific dummies, X_{nt} is a vector of factors other than the merger affecting operating costs, δ_n is a network specific fixed effect, $Treat_n$ is a dummy variable taking the value 1 for networks belonging to the treatment group, $I(t = j)$ are time dummies for all periods except the period just before the merger and e_{nt} is the error term. In equation 2.3, all coefficients βj with $j < 2010$ are placebo tests for whether the treatment had an effect on costs between the two groups prior to the merger. This should not happen because if the treatment had an effect before it even occurred, this casts doubt on the parallel trends assumption.

The estimated coefficients βj are plotted in Figures 2.5a to 2.5d. 2.5a and 2.5b show estimates of equation 2.3 with X_{nt} including only the output of the network

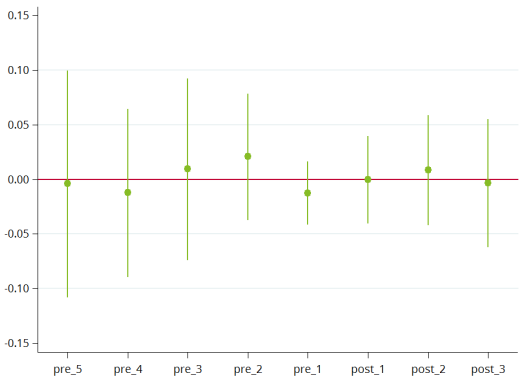


(a) Control group – C1

(b) Control group – C2



(c) Control group – C1



(d) Control group – C2

Figure 2.5: Time relative to the merger, where (a) and (b) include output as covariate and (c) and (d) include both output and input prices as covariates

reflected by the number of seat-kilometers supplied. 2.5c and 2.5d show estimates of equation 2.3 with X_{nt} including also labor and material prices. On top of verifying whether there is a difference between the two groups before the merger, which is reflected by coefficients βj with $j < 2010$, βj with $j > 2010$ show how the treatment effect evolves over time after the merger. We might expect the treatment effect to grow as time passes by since change can take time to implement after a merger. These graphs show that none of the coefficients are significant (at a 5% significance level) in the pretreatment period, confirming the parallel trends assumption. It also shows that we do not observe any significant effect after the merger either.

The other key assumption in the application of the DiD approach is that the choice to merge with Veolia Transport is not endogenous. The decision by Transdev to merge with another company was not linked in any way to operating costs of net-

works operated in France or factors influencing them. Transdev belongs to a public financial institution. Its initiative to merge with another French transport company must be understood within this context and the specific situation at that time. Transdev and RATP were not satisfied by the partnership they had concluded in 2002, consequently, RATP wanted to divest its 26% share of Transdev and develop its subsidiary RATP Dev. The owner of Transdev, a public institution, hence started looking for a new partner, with the idea that competition between four French transport groups for contracts abroad was likely to be detrimental to the success of those groups and therefore to the French transport industry, and that the creation of a very large group would help win contracts abroad. The initiative of Transdev was hence strategic for the development of the French transport industry through the winning of contracts for the operation of networks abroad.

The specific choice of Veolia Transport is neither endogenous to operating costs of networks. According to a report about the merger published in 2016 by the French Court of Audit (Cour des Comptes [2016]), Veolia Transport and Keolis were both serious candidates and the choice of one of them over the other did not prevail in theory[18]. A comparative examination of the two offers was organized by the owner of Transdev but this comparative examination was made very quickly. For example the elements of valuation and financial structuring of the transaction were not taken into account in this comparative analysis. According to this report, *"subjected to pressure by Veolia Environnement through the media, the CDC did not wish to deepen negotiations [...]. This choice is probably not independent from the fact that the CDC was also the largest shareholder of Veolia Environnement. The CEO of CDC was in favor of a merger with Veolia Transport*[19] *"*. Keolis was hence excluded from the process and the CDC and Veolia entered into exclusive negotiations on the merger of their subsidiaries. This analysis of the French Court of Audit is a soft version of the information that can be found in the press. The daily information newspaper Le Parisien explained in 2009 that the general secretary of

[18]Regarding operating costs of networks operated in France, a comparison of means of unit costs (operating costs per seat-kilometers) of networks confirms that the two candidates were similar. Average unit operating costs of Keolis amount to €0.032 per seat-kilometer and average unit operating costs of Veolia amount to €0.035 per seat-kilometer. A t test of the difference in means of unit costs between the two groups shows that we cannot reject the null hypothesis that the means are equal.

[19]Cour des Comptes [2016], page 436. Translation from French by the Authors.

the French president intervened to tip the balance in favor of Veolia, whose CEO at the time was close to the French president. The left-wing political party PS made a statement to denounce the conditions under which Veolia had been chosen, which seemed to be primarily a political decision sponsored by the French president in order to satisfy the top management of Veolia[20]. An investigation by the French newspaper Mediapart published in June 2012 argues that Veolia Transport was chosen by the CDC because of the private relationship between the ex CEO and non executive president of Veolia and the CEO of CDC so that the choice of Veolia Transport was mainly motivated by private interests[21]. We are thus strongly convinced that the treatment is not endogenous to operating costs of networks operated in France.

Results

Our preliminary analysis consists in the comparison of costs of the merging companies before and after the merger at the beginning of 2011. The results of estimating equation 2.1 are given in Table 2.7. Models $(M1)$ – $(M3)$ are simple ordinary-least square regressions, whereas models $(M4)$ – $(M6)$ include fixed effects to account for the time-invariant heterogeneity between networks. Note that the regressions include a time trend to control for the steady increase in operating costs observed over time. The before-after estimations suggest that operating costs of Veolia Transport and Transdev have decreased post merger. However none of the results are significant. Hence we cannot reject the hypothesis that operating costs of the merging parties did not change as a result of the merger[22]. As expected, a positive variation in output impacts cost positively. Similarly, an increase in labor and material price, *ceteris paribus*, increase costs. As explained before, the before-after analysis does not control for changes in economic factors that may impact operating costs but are unobservable to the econometrician. In order to account for these factors we perform a DiD estimation, where the costs of the merging parties are compared to

[20]The article in the French newspaper Le Parisien is available at: http://www.leparisien.fr/economie/un-geant-du-transport-naitra-de-la-fusion-veolia-transdev-23-07-2009-588430.php.

[21]The French newspaper Mediapart published an investigation on the merger in June 2012. See the article "Veolia Transdev : the secrets of a financial mega-disaster", by Laurent Mauduit, June 2012, 28, Mediapart.

[22]The analysis was also performed using operating costs per seat-kilometers, which correspond to operating costs per unit of output, as dependent variable. Results are unchanged by this modification and are available upon request.

carefully designed control groups.

Table 2.7: Before and After estimation

	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)
Post–merger	-0.0045	-0.045	-0.060	-0.0045	-0.014	-0.015
	[0.036]	[0.051]	[0.042]	[0.036]	[0.034]	[0.014]
lnY		1.08***	1.03***		0.24**	0.25**
		[0.064]	[0.068]		[0.11]	[0.10]
lnw_l			0.49			0.49***
			[0.43]			[0.13]
lnw_m			0.25*			0.15***
			[0.13]			[0.041]
year	0.039***	0.024**	0.014	0.039***	0.036***	0.024***
	[0.0073]	[0.010]	[0.016]	[0.0073]	[0.0069]	[0.0033]
Constant	-70.0***	-53.4**	-34.8	-70.0***	-66.3***	-44.6***
	[14.7]	[20.5]	[31.2]	[14.7]	[13.6]	[7.28]
Fixed effects	no	no	no	yes	yes	yes
Clustered SE	yes	yes	yes	yes	yes	yes
Observations	117	117	117	117	117	117
R2	0.01	0.95	0.95	0.66	0.72	0.83

Clustered (at network level) standard errors in brackets.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results of estimating equation 2.2 are presented in Table 2.8 and Table 2.9 respectively for control groups $C1$ and $C2$. As regards our first control group $C1$ (Table 2.8), the point estimates of the coefficients of interest in the regressions which do not include fixed effects (models $(M1)$ to $(M3)$) are low in value (between 1.5% and 3%, depending on the specification) and insignificant. In the regressions with fixed effects (columns $(M4)$ to $(M6)$) they are substantially lower but remain insignificant. The coefficients of interest are similar in value and insignificant for our second control group $C2$ (Table 2.9). In all regressions considered, coefficients on the remaining covariates are of the expected signs and magnitudes.

In order to address serial autocorrelation issues, standard errors are clustered by network (see Bertrand et al. [2004]) in all regressions. Our estimation samples contain respectively 32 networks or 26 networks when considering either control group $C1$ or $C2$. We are aware that the small number of clusters implied by the num-

ber of networks can lead to biased standard errors and misleading inference. In our case, the risk is to underestimate serial correlation between errors and underestimate standard errors. This potential underestimation of standard errors is however not likely to impact our conclusions since our coefficients of interest are never significant at the 10% level anyway. We thus conclude that the merger did not lead to cost efficiencies[23].

Table 2.8: Difference-in-differences – Control group C1

	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)
Post–merger × *Treatment*	0.030	0.015	0.016	0.014	-0.0022	0.00076
	[0.049]	[0.048]	[0.049]	[0.029]	[0.029]	[0.029]
Post–merger	0.041**	0.012		0.11***	0.074***	
	[0.018]	[0.026]		[0.017]	[0.021]	
Treatment	0.070	0.070	0.070			
	[0.072]	[0.067]	[0.068]			
lnY	1.01***	0.97***	0.97***	0.46***	0.45***	0.38***
	[0.041]	[0.043]	[0.043]	[0.089]	[0.089]	[0.086]
lnw_l		0.47*	0.45*		0.53***	0.41***
		[0.25]	[0.26]		[0.12]	[0.12]
lnw_m		0.12	0.13		0.15***	0.16***
		[0.086]	[0.093]		[0.040]	[0.043]
Constant	-3.66***	-5.26***	-5.20***	2.87**	0.69	1.82*
	[0.49]	[0.99]	[1.01]	[1.06]	[1.09]	[1.01]
Fixed effects	no	no	no	yes	yes	yes
Clustered SE	yes	yes	yes	yes	yes	yes
Year dummies	no	no	yes	no	no	yes
Observations	288	288	288	288	288	288
R2	0.96	0.96	0.96	0.67	0.75	0.80

Clustered (at network level) standard errors in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

2.4.4 Robustness checks – balanced panel

This section presents a series of robustness checks done on the balanced panel. Table 2.10 presents the results excluding the years 2009 and 2010, corresponding to the period ranging from the announcement of Transdev wanting to merge to the merger

[23]The analysis was also performed using operating costs per seat-kilometers, which correspond to operating costs per unit of output, as dependent variable. Results are unchanged by this modification and are available upon request.

Table 2.9: Difference-in-differences – Control group C2

	(M1)	(M2)	(M3)	(M4)	(M5)	(M6)
Post–merger × *Treatment*	0.050	0.027	0.027	0.017	-0.00086	0.0010
	[0.050]	[0.048]	[0.049]	[0.031]	[0.030]	[0.031]
Post–merger	0.021	-0.015		0.11***	0.067***	
	[0.019]	[0.026]		[0.019]	[0.018]	
Treatment	0.060	0.071	0.071			
	[0.077]	[0.070]	[0.071]			
lnY	1.02***	0.98***	0.98***	0.46***	0.45***	0.39***
	[0.045]	[0.045]	[0.046]	[0.096]	[0.094]	[0.090]
lnw_l		0.67**	0.66**		0.61***	0.47***
		[0.25]	[0.26]		[0.10]	[0.10]
lnw_m		0.13	0.14		0.15***	0.15***
		[0.11]	[0.12]		[0.030]	[0.038]
Constant	-3.77***	-6.08***	-6.02***	2.89**	0.43	1.61
	[0.54]	[1.08]	[1.12]	[1.14]	[1.12]	[1.00]
Fixed effects	no	no	no	yes	yes	yes
Clustered SE	yes	yes	yes	yes	yes	yes
Year dummies	no	no	yes	no	no	yes
Observations	234	234	234	234	234	234
R2	0.96	0.96	0.96	0.67	0.77	0.82

Clustered (at network level) standard errors in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

itself. The aim of this test is to rule out the possibility of operating costs of Veolia Transport, Transdev or its rival groups to be affected by the announcement of the merger. As shown in Table 2.10, our results are not modified by the exclusion of the years 2009 and 2010.

Table 2.10: Difference-in-differences estimation excluding the years 2009–2010

	(M1)–C1	(M2)–C1	(M1)–C2	(M2)–C2
Post–merger × *Treatment*	0.034	0.017	0.033	0.0081
	[0.032]	[0.036]	[0.036]	[0.041]
lnY	0.43***	0.40***	0.42***	0.40***
	[0.088]	[0.093]	[0.093]	[0.099]
lnw_l		0.31**		0.42***
		[0.13]		[0.12]
lnw_m		0.16**		0.15***
		[0.059]		[0.054]
Constant	3.20***	1.95*	3.32***	1.62
	[1.03]	[1.10]	[1.11]	[1.11]
Fixed effects	yes	yes	yes	yes
Clustered SE	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
Observations	224	224	182	182
R2	0.78	0.81	0.79	0.83

Clustered (at network level) standard errors in brackets.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The fact that we do not observe any significant average result might suggest that our framework fails to take into account some important underlying heterogeneity in the behavior of networks exploited by the two merging parties, Veolia Transport and Transdev. In particular, the effects of the merger may be different whether we consider networks of Veolia Transport or Transdev. To address this question, the term of interest *Post* is interacted with a dummy variable associated to the merging transport group that managed the network prior to the merger, that is $Veolia$ or $Transdev$. We hence examine whether the effect of the merger differs between the networks operated by the respective groups, as shown in Table 2.11. When considering these separate effects, we find that the effect of the merger on operating costs remains insignificant irrespective of the party of the concentration considered.

Table 2.11: Difference-in-differences estimation with interaction of treatment (identity of merging group)

	(M1) – C1	(M2) – C1	(M1) – C2	(M2) – C2
Post merger × *Veolia*	0.010	-0.0079	0.011	-0.0095
	[0.033]	[0.034]	[0.036]	[0.035]
Post merger × *Transdev*	0.016	0.027	0.017	0.031
	[0.043]	[0.042]	[0.045]	[0.046]
lnY	0.38***	0.38***	0.38***	0.38***
	[0.089]	[0.085]	[0.095]	[0.088]
lnw_l		0.42***		0.49***
		[0.13]		[0.10]
lnw_m		0.16***		0.15***
		[0.044]		[0.039]
Constant	3.71***	1.83*	3.82***	1.62
	[1.04]	[1.00]	[1.12]	[0.98]
Fixed effects	yes	yes	yes	yes
Clustered SE	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
Observations	288	288	234	234
R2	0.75	0.80	0.76	0.82

Clustered (at network level) standard errors in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Another potential source of heterogeneity in the behavior of networks may be the contract type in place in a network throughout a contractual period. Gagnepain and Ivaldi [2017] suggests that operating costs may differ depending on the type of regulatory contract type in place (fixed-price or cost-plus). In particular, fixed-price contracts generate more incentives for cost reductions than cost-plus contracts. We hence examine whether the effect of the merger differs between fixed-price and cost-plus contracts. Table 2.12 reports the estimated coefficients for heterogeneous treatment effects. The term $Post \times Treat$ is interacted with the dummy variable associated to the choice of contract type, where FP refers to fixed-price contracts and CP to cost-plus contracts. Given that we include network fixed effects in our specifications, the coefficients of interest solely rely on two changes of contract type in our sample, of which one concerns our treatment group so our results have to be interpreted with caution. Our results suggest that there is no significant difference in the effect of the merger on networks regulated under cost-plus contracts and networks regulated under fixed-price contracts. We conclude that the effect of the merger on the merging groups did not differ significantly depending on the contract type in place and remains insignificant.

Finally, we also consider the effects of mergers, depending on whether the merging parties were direct local competitors prior to the merger. We introduce two definitions of such networks. The first consists of networks of one of the merging party such that another network was operated by the other merging party in the same county. The second consists of networks of one of the merging party such that another network was operated by the other merging party in the same or neighboring counties. The results of the respective specifications are presented in Tables 2.13 and 2.14. Accounting for whether the merging parties were direct local competitors prior to the merger, we find no merger-specific efficiency gains.

2.4.5 Robustness checks – unbalanced panel

An additional robustness check consists in performing the analysis on an unbalanced panel. We did not use this sample for the main analysis because networks can change from the control groups to the treatment groups and vice versa, depending on their operators and the composition of the treatment and control groups change over

Table 2.12: Difference-in-differences estimation with interaction of treatment (contract type)

	(M1) – C1	(M2) – C1	(M3) – C2	(M4) – C2
Post–merger × *Treatment* × *FP*	0.0096	-0.0011	0.011	-0.00079
	[0.032]	[0.032]	[0.035]	[0.034]
Post–merger × *Treatment* × *CP*	0.053	0.031	0.053	0.033
	[0.033]	[0.031]	[0.034]	[0.033]
FP	0.090**	0.062*	0.087*	0.060*
	[0.044]	[0.031]	[0.043]	[0.033]
lnY	0.38***	0.38***	0.38***	0.38***
	[0.084]	[0.084]	[0.090]	[0.088]
lnw_l		0.40***		0.46***
		[0.13]		[0.11]
lnw_m		0.16***		0.15***
		[0.044]		[0.039]
Constant	3.67***	1.83*	3.76***	1.61
	[0.99]	[0.99]	[1.06]	[0.97]
Fixed effects	yes	yes	yes	yes
Clustered SE	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
Observations	288	288	234	234
R2 – adjusted	0.74	0.80	0.75	0.81

Standard errors in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.13: Difference-in-differences estimation with interaction of treatment (local competitors - same county)

	(M1) – C1	(M2) – C1	(M3) – C2	(M4) – C2
Post merger × *Treatment* × *direct*	0.0034	-0.010	0.0043	-0.0094
	[0.018]	[0.019]	[0.022]	[0.021]
Post merger × *Treatment* × *non-direct*	0.013	0.0027	0.014	0.0029
	[0.032]	[0.033]	[0.036]	[0.035]
lnY	0.38***	0.38***	0.38***	0.39***
	[0.088]	[0.086]	[0.094]	[0.090]
lnw_l		0.41***		0.47***
		[0.12]		[0.10]
lnw_m		0.16***		0.15***
		[0.043]		[0.038]
Constant	3.70***	1.82*	3.80***	1.61
	[1.03]	[1.01]	[1.11]	[1.00]
Fixed effects	yes	yes	yes	yes
Clustered SE	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
Observations	288	288	234	234
R2 – adjusted	0.74	0.79	0.75	0.81

Clustered (at network level) standard errors in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.14: Difference-in-differences estimation with interaction of treatment (local competitors - same or neighboring counties)

	(M1) – C1	(M2) – C1	(M3) – C2	(M4) – C2
Post merger × *Treatment* × *direct*	0.0018	-0.0046	0.0034	-0.0032
	[0.032]	[0.031]	[0.035]	[0.033]
Post merger × *Treatment* × *non-direct*	0.047	0.021	0.048	0.018
	[0.029]	[0.043]	[0.032]	[0.043]
lnY	0.40***	0.39***	0.40***	0.39***
	[0.086]	[0.088]	[0.092]	[0.092]
lnw_l		0.40***		0.46***
		[0.12]		[0.11]
lnw_m		0.16***		0.16***
		[0.042]		[0.036]
Constant	3.53***	1.76	3.61***	1.55
	[1.01]	[1.04]	[1.09]	[1.03]
Fixed effects	yes	yes	yes	yes
Clustered SE	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes
Observations	288	288	234	234
R2 – adjusted	0.74	0.79	0.75	0.81

Standard errors in brackets.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

time due to missing values in the dataset. However, the key advantage of this panel is that we observe many more networks as compared to our balanced panel. As a result, we are able to perform the analysis on one additional control group, exploiting information about tenders for the choice of a transport operator. Secondly, it allows us to address the risk of underestimated standard errors resulting from too few clusters (networks) being included in our main analysis.

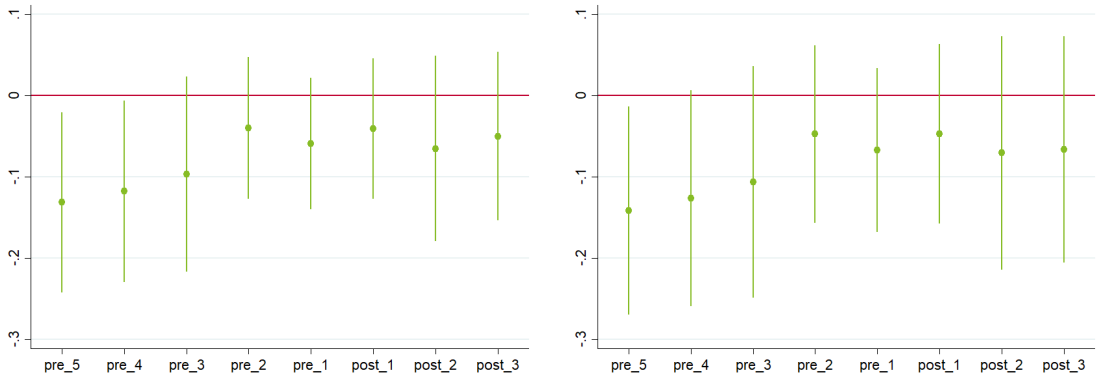
As in the case of our main analysis, we verify our identification strategy by plotting the conditional distribution of treatment time specific effects. We consider two specifications: (1) including only output as covariate (see Figure 2.6) and (2) including both output and input prices as covariates (see Figure 2.7). These figures show that, when both output and input prices are included, none of the coefficients is significant at a 5% significance level in the pretreatment period, providing evidence that the parallel trends assumption holds for the control groups (see Figure 2.7). When only output is included, the effects which correspond to 2006 and 2007 are significant and negative for $C1$ and the effect which corresponds to 2006 is significant and negative for $C2$ (see Figure 2.6), hence the parallel trends assumption is less robust for these control groups when input prices are not included in the analysis.

The results of estimating equation 2.2 on our unbalanced sample are presented in Table 2.15 for control groups $C1$, $C2$ and $C3$ respectively. As in our main analysis, we find no merger efficiency gains.

2.5 Discussion

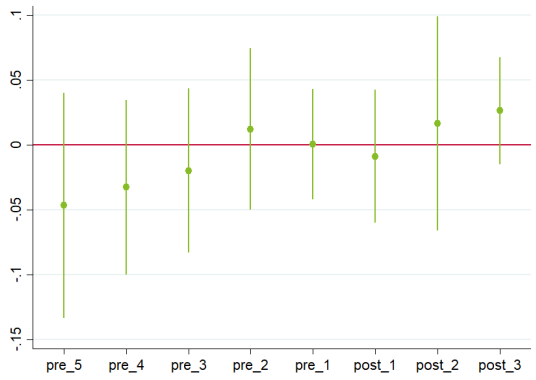
Our results clearly demonstrate that operating costs of networks operated in France by Veolia Transport and Transdev did not decrease following the merger. Local operators explain this finding by the fact that margins in the sector are extremely low and operating costs cannot be further reduced. Can we hence conclude from this failure to produce efficiency gains that such a change in market structure in the transport sector cannot be a way to decrease costs?

To understand our results, we turned to the annual report of the French Court of Audit (Cour des Comptes), published in 2016 (see Cour des Comptes [2016]), which deeply examines the merger that we study in this chapter. The title of the



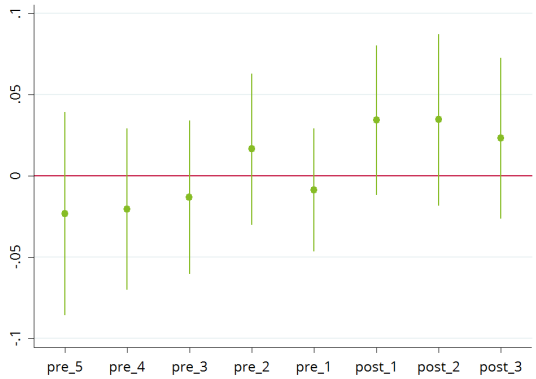
(a) Control group – C1

(b) Control group – C2

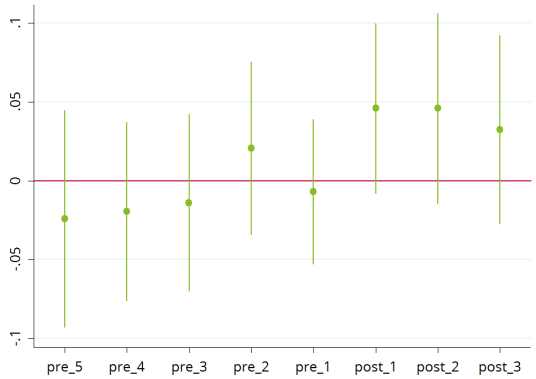


(c) Control group – C3

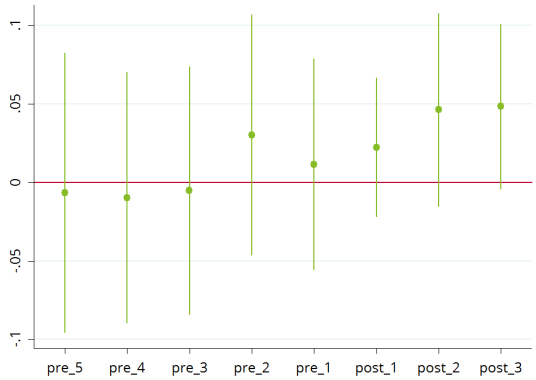
Figure 2.6: Time relative to the merger, including output as covariate



(a) Control group – C1



(b) Control group – C2



(c) Control group – C3

Figure 2.7: Time relative to the merger, including both output and input prices as covariates

Table 2.15: Difference-in-differences estimation (unbalanced panel)

	(M1) – C1	(M2) – C1	(M3) – C2	(M4) – C2	(M5) – C3	(M6) – C3
Post–merger × *Treatment*	0.030	0.029	0.028	0.033	0.024	0.017
	[0.024]	[0.022]	[0.024]	[0.022]	[0.030]	[0.031]
Treatment	-0.14*	-0.0029	-0.21	0.0078	0	0
	[0.082]	[0.032]	[0.13]	[0.060]	[.]	[.]
lnY	0.53***	0.41***	0.52***	0.40***	0.21***	0.26***
	[0.10]	[0.053]	[0.11]	[0.054]	[0.070]	[0.053]
lnw_l		0.41***		0.42***		0.45***
		[0.071]		[0.076]		[0.086]
lnw_m		0.089***		0.089**		0.065*
		[0.033]		[0.034]		[0.037]
Constant	1.92	1.56**	2.05*	1.61**	5.40***	3.10***
	[1.17]	[0.62]	[1.17]	[0.64]	[0.79]	[0.64]
Fixed effects	yes	yes	yes	yes	yes	yes
Clustered SE	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Observations	783	774	725	716	502	493
R2 – adjusted	0.61	0.74	0.60	0.73	0.48	0.70

Standard errors in brackets.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

report, which is quite compelling, is *"A hasty decision, a poorly prepared and poorly conducted project"* [translated by the Authors from French]. It appears in the report that the owner of Transdev, CDC, heavily underestimated the difficulties and risks of the operation.

The first salient point is that the choice of Veolia Transport by Transdev was made extremely quickly and consequently, the project was insufficiently studied and the business plans presented by both Transdev and Veolia Transport were too optimistic (in terms of gasoline price, cost efficiency gains and growth of activity in France). The two candidates, Veolia and Keolis, had received only six days to answer to the specifications set out by Transdev. Transdev did not wish to deepen the negotiations with the two candidates and rapidly chose Veolia Transport. This choice was most probably linked to the fact that the owner of Transdev (CDC) was the main shareholder of Veolia Environnement (the owner of Veolia Transport) and that the chief Executive officer of CDC was in favor of a merger with Veolia Transport.

The second salient point is that Transdev minimized the difficulties linked to the compatibility between the models and corporate cultures of the two companies, which were quite different. The trust of Transdev's clients was linked to its belonging

to the CDC, a public financial institution and to proximity management. Concerning Veolia, the business approach was different and relied on the entire group's activities. The ability of the teams to work together was also a key condition for success. Yet Transdev's management had indicated in a *"contribution to the instruction"* dated June 5, 2009, that it was unfavorable to the draft merger with Veolia Transport. Clients were very skeptical with the new company and teams were demotivated from the beginning of the project. This explanation corroborates the management literature, which stresses that culture conflict is a major source of failures of mergers (see for instance Steigenberger [2017] or Caiazza and T.Volpe [2015] for a review of this literature). In one often cited study, culture was found to be responsible for 30% of failed integrations (see Dixon [2005]). Notwithstanding, culture is most of the time neglected when the benefits of potential mergers are examined. It often seems to be unimportant compared to efficiency gains from combining resources or knowledge, although cultural clashes can completely prevent merger efficiency gains from materializing (see Weber and Camerer [2003]).

The third salient point is that the merger was not well prepared even if it took the companies twenty-one months to obtain approval of competition authorities. A change in the rules of the game was decided one month before the closing and shareholders did not manage to agree in time on the operational side. For example, the CEO of Transdev was supposed to become the CEO of the merged company but was discarded in favor of a CEO coming from outside a month before the closing. The CEO of Veolia Transport, who was to become COO, was also discarded. The new CEO, which came from CDC, was proposed by Veolia Environnement. He was recruited with a contract signed with Veolia Environnement. On the operational side, at the time of the closing of the transaction in March 2011, several operational questions were still not resolved. The merger was in fact a juxtaposition of two legal entities and two organizations. For instance, no file on the subject was transmitted to the representative bodies of the workforce, no decision was made on the new brand and logo, on the reorganization of the networks in France and abroad or on the location of the headquarters of the new group.

The report concludes that *"The merger of Transdev, a CDC subsidiary, with Veolia Transport, a subsidiary and division of Veolia Environnement, was decided hastily, insufficiently studied and conducted in a deficient manner. If corporate mergers are*

complex processes whose results are frequently disappointing, particularly with regard to valuation and synergies achieved, it is clear that in this case the CDC heavily underestimated the difficulties and risks of the operation. It very quickly favored the choice of Veolia Transport and accepted the accelerated pace desired by Veolia Environnement. In doing so, it was deprived of the opportunity to further analyze the relevance and feasibility of the operation, contrary to the recommendations of the Supervisory Commission and the Minister of the Economy. As a result of this precipitation, the conditions set out in the initial agreement signed on July 22, 2009, have all been called into question at a later date. [...] More generally, this transaction revealed a significant weakness in the governance of the CDC. It is indeed essential that investment or disinvestment decisions on major issues cease to rest solely on the responsibility of the CEO and, as in all entities of this size, effectively involve at the various stages of the decision and of the negotiation the body in charge of supervising the institution and the action of the CEO[24] *".*

This analysis of the French Court of Audit provides a convincing explanation of why merger efficiency gains did not materialize. It shows that this failure is highly specific to the case at stake and that consequently our result cannot be generalized to the industry. It also highlights that the specific context in which a merger takes place (justifications for the merger, differences in culture between the companies, perception of the merger by clients and employees, preparation of the merger, etc.) are highly relevant dimensions to take into account when assessing the potential impacts of a merger.

2.6 Conclusion

The goal of the analysis presented in this chapter was to contribute to the growing literature that attempts to evaluate antitrust policy towards horizontal mergers, by studying explicitly merger efficiency gains. We employ a difference-in-differences methodology to study potential merger efficiency gains from a greatly debated merger which took place between Veolia Transport and Transdev in the French urban public transport industry in 2011.

[24] Cour des Comptes [2016], pages 454 and 455. Translated by the Authors from French.

There exists little evidence in the literature on whether large horizontal mergers result in efficiencies. This lack in the literature can be explained by data limitations. Given the particularity of our industry and available data, we were able to introduce a direct test for merger-specific efficiencies.

Our results show that the merger did not lead to any decrease in operating costs for the merging parties. Our study relies on the use of several control groups. It is robust to a great number of robustness checks as well as to the introduction of heterogeneous treatment effects, depending on the identity of the merging party, the contract type in place and the closeness of competition of local operators.

A possible explanation of why the efficiency gains expected by the parties to the merger did not materialize is that the choice of Veolia was made too hastily, the merger was poorly prepared and the differences in cultures between the two groups made both clients and employees reluctant to the merger. These explanations are highly specific to the case at hand, hence we cannot conclude from our result that a change in market structure in the sector of urban transport cannot lead to efficiency gains. The role played by the context (culture, choice of the target, perception by clients and employees, etc.) in the lack of materialization of efficiency gains calls into question whether it should be given more weight by economists in their research and by competition authorities in their ex ante analyses of potential effects of mergers.

CHAPTER 3

Buyer's discretionary power and the selection of efficient firms in public procurement*

*This chapter was written with Marion Chabrost (Compass Lexecon). We are extremely thankful to InfoPro for providing the complete database on public tenders in France for the purpose of our research. We are grateful to Francesco Decarolis, Stéphane Saussier, Giancarlo Spagnolo and Carine Staropoli for their precious and helpful comments. All errors are our own.

Abstract

In this chapter, we document the causal effect of increasing buyer's discretion on the relative efficiency of the selected firm by combining a large database of public tenders in France with financial information on selected firms. In Europe, tenders above a given threshold have to be awarded through open auctions. Below this threshold, contracts can be awarded through open auctions or adapted procedures. The latter introduces flexibility and increases discretionary power by letting the buyer choose how the tender is organized and how the winner is selected. Using an instrumental procedure to solve the potential endogeneity of the choice of the awarding mechanism, we assess whether the use of an adapted procedure makes the selection of a more productive firm more likely compared with an open auction. Our main result is that the adapted procedure leads to the selection of relatively less efficient firms than an open auction, in particular in tenders related to public works. We extend our analysis to explain the mechanism that underpins our results. Our results suggest that the selection of less productive firms in adapted procedure is explained by a misuse of discretionary power when screening bids. If the selection of more productive firms is more likely to lead to lower costs and/or better quality outcomes, increasing discretion is potentially in contradiction with the primary objective of public procurement, which is to get the best outcome at the lowest price. Allowing for more discretion is also in contradiction with one potential secondary objective of public procurement, which would be to promote productivity.

Key words: Production functions, Productivity, Public Procurement, Award Procedure, Instrument Variables Estimation.

JEL classification: D24, H57, C26.

3.1 Introduction

Public procurement is the process of purchasing goods or services by the public sector. Alone, it accounts for 12% of GDP and 29% of total government expenditures on average across OECD countries and approximately 14% of GDP in the European Union (see OECD [2017b]). Given the sheer amount of money involved, public procurement has the potential to pursue broad policy objectives. As stated by the OECD, *"[G]overnments are increasingly recognising the immense power of public procurement to solve global societal challenges, improve productivity and boost innovation, while ensuring value for money"*. Whereas the economic literature has started to assess the capability of public procurement to solve societal issues and to be a tool for innovation, its relationship with productivity has been neglected so far.

This chapter compares the productivity of suppliers selected in competitive tenders organized by public buyers using two different types of award procedures. The first type is open auction. In this procedure, buyers are highly constrained by strict rules on how to organize the tender and select a supplier. In particular the supplier has to be selected without negotiation on precisely defined criteria. The main benefit of this procedure is that it fosters transparency and competition (Bulow and Klemperer [1996]). The second type of procedure we focus on is called adapted procedures. In this procedure, public buyers are endowed with a high degree of discretionary power in many aspects of the award (e.g. publicity, deadline, negotiations and restriction of competition to some invited bidders). This procedure is characterized by a lower degree of transparency than open auctions, but one of its main benefits is its possibility to adapt more easily to the specificities and circumstances of the procurement and hence to reduce transaction costs. An extensive literature addresses the question of which degree of discretion in the award mechanism yields the most efficient outcome in public procurement. Whereas the outcome has been measured through different aspects of the tender such as price, quality or renegotiation, the productivity of the selected supplier has been ignored.

We evaluate whether an award procedure which increases the discretionary power of the buyer results in the selection of more or less productive firms. The question we address is hence that of the effect of increasing discretion on the selection of suppliers. If the selection of more productive firms is more likely to lead to lowered costs and/or better quality outcomes, then selecting more productive suppliers should result in a better value for money of the contract, which is the primary objective of public procurement. Second, if public procurement is to be used as a tool to enhance productivity and growth, it is worth determining whether increasing discretion through some types of procedures allows to select more efficient firms, keeping in mind that the use of public procurement to foster productivity may be questionable if it is not cost-effective.

Our main results indicate that the adoption of an adapted procedure makes the selection of an efficient supplier less likely. This results in an inefficient allocation of public funds towards less efficient firms. The magnitude of the effect is large. Our results are robust to several robustness checks which are presented in the chapter. The first contribution of the chapter is to study a dimension of procurement that has been neglected so far, which is the effect of increasing discretion on the ability to select an efficient supplier. The second contribution comes from the policy implication of the result, namely that a selection procedure which increases discretionary power is potentially in contradiction with the main objective of public procurement which is to get the best outcome at the lowest price, and with one potential broader objective of public procurement, which would be to promote productivity. The third contribution of the chapter is to identify the role of some observed characteristics of the buyer, the contract and the economic environment in selecting a procedure, in line with the work in Bajari et al. [2009].

The economic literature on how to organize public procurement is abundant. It is mainly interested in identifying the level of discretion in selection procedures that yields the best value for money. Auction theory shows that open auctions achieve the lowest ex ante price (see for example Bulow and Klemperer [1996], Cameron [2000] and Decarolis [2014]) and impede corruption and favoritism by fostering transparency (Burguet and Che [2004]). Both suggest that open auctions achieve the best value for money in public

procurement. This view was challenged by the theory of contracts where other aspects are also considered. It shows that open auctions might not be the best option when contracts are particularly complex and hence subject to unexpected events (Goldberg [1977]), when quality dimensions are not easily contractible (Manelli and Vincent [1995]) or to sustain reputational mechanisms and long-term relationships (Kim [1998], Spagnolo [2012]). In these cases, introducing some level of discretion in the award procedures could yield a better outcome. One of the contributions of this chapter is to complement this literature by looking at the ability of procedures that increase the discretionary power of the buyer to select the most productive firms.

The analysis is performed using a unique dataset of public procurement contracts in France between 2006 and 2015. It takes advantage of the French regulatory framework for public procurement, which has allowed the use of flexible competitive bidding procedures and hence opened room for discretionary power in 2004. In most countries and organizations, the rules on which public procurement lays on aim at fostering transparency and efficiency. In this perspective, the use of competitive and transparent award procedures are promoted by international institutions (e.g. the World Bank, the OECD) and in many countries, public procurement rules set thresholds for contract value above which the public buyer must use open competitive procedures. In Europe, the European Commission sets thresholds above which the use of strictly regulated open auctions is mandatory. Below these thresholds, national laws apply. In France, below the thresholds set by the European Commission, public buyers are allowed to choose between using a strictly regulated procedure consisting in an open auction, or a more flexible procedure implying more discretionary power, named the adapted procedure. The latter procedure gives some freedom to the buyer on how to advertise and design the tender and how to select the winner, including the possibility of negotiation.

We combine two main sets of data. The first one is a collection of calls for tenders for public contracts procured in France between 2006 and 2015. It includes every call for tenders in France (i.e. around 80K observations per year) and contains information on the identity of the winning firm only for a sub-sample of contracts (i.e. around 14K observations per

year). The second dataset, Amadeus, is a panel of financial information of European firms. We use it to compute labor and total factor productivity of firms. We limit our estimation sample to contracts below the thresholds set by the European Commission so that in our sample, public buyers can choose between the two types of procedure studied. Note that these contracts represent a high share of total public procurement: in construction works, they account for 40% of the total value in European procurement (see Palguta and Pertold [2017]). The threshold for public works is much higher than other sectors (around €5 million and 0.2 million respectively). The limitation of the sample to contracts below the thresholds has the implication of limiting the analysis to contracts of simple to moderate complexity for supplies, studies and services, hence reducing the risk of contract incompleteness leading to costly renegotiations, and to contracts of simple to high complexity for public works.

Our econometric strategy must take into account the potential endogeneity of the choice of procedure. Indeed, we expect that some unobserved contract-specific and buyer-specific characteristics may affect both procedure and supplier selection, resulting in a potential correlation between the procedure chosen and the error term as a consequence of omitted variables (e.g. the degree of capture of the buyer, the specific knowledge of the buyer, etc.). To solve this concern for endogeneity, we instrument the choice of procedure and use a two-stage least square model. Our identification strategy relies on an instrument that draws on Guasch et al. [2007]. Our instrument is the prevalence of adapted procedures in the three months preceding the month of the tender among close by buyers (i.e. buyers located in a close geographic area). It is highly correlated with the choice of the award procedure because of the inertia in adopting the new flexible procedure over time and the spill-over effect of buyers located in a close geographic area. Many empirical papers indeed demonstrate the significant influence of neighbors in organizational choices. Christoffersen and Paldam [2003] considers multiple cases of public services in Danish municipalities and finds a strong diffusion effect from neighboring municipalities when choosing their mode of public service provision. This finding has been confirmed by Bel and Miralles [2003] and Miralles [2009], which also demonstrate the existence of such spill-over effect among close

by municipalities. The instrument does not impact the choice of a relatively more or less efficient company directly as it is unrelated to buyer and contract-specific characteristics.

The mechanism through which the adapted procedure could lead to the selection of less efficient firms are discussed in the last section of the chapter. We have identified three channels which could explain our main result. First, it could be that firms self-select in some specific procedures. Second, it could be that buyers invite only some specific types of firms to bid in adapted procedures. Third, it could be that pools of bidders contain the most productive firms in both types of procedures but that the screening of firms leads to different outcomes. To discriminate between these channels, we would ideally need the identities of all the bidders in the tenders to compare the pool of bidders in the two procedures. However, this information is not available in our dataset. We hence look at the number of bidders and the characteristics of the winners. We demonstrate that the number of bidders is on average similar in both types of procedures, and that our main result is not driven by the adapted procedure selecting smaller, less profitable, more recent or more local firms. This suggests that buyers do not only invite some specific types of firms (in terms of age, size, profitability and localization at least) to participate in adapted procedures, which suggests that we can discard the second channel. Self-selection into procedures by firms would drive our result if the most productive firms did not bid in adapted procedures. However, there does not seem to be any reason why a productive firm that participates in open auctions would not do so in the case of adapted procedures since participating in open auctions is more costly than participating in adapted procedures. This suggests that our result is driven by the pure effect of discretion in the screening of firms, even if one would need to deepen the analysis by looking at the bidders in different types of procedures to draw a definite conclusion.

Two reasons could explain why public buyers select less efficient firms in adapted procedures. The first possible reason is that the public buyer chooses a procedure with increased discretion to be able to select a firm that it wishes to favor (for example if the public buyer is corrupted) so that the public buyer does not even try to select an efficient firm. The second possible reason comes from the purpose of the adapted procedure, which is to be

adaptable to the circumstances of the purchase in order to save on ex ante transaction costs, including publication costs or screening costs. In this case, a public buyer would select a less efficient firm using the adapted procedure because he would spend less in the selection process. Put differently, the loss in productivity can be seen as the cost of reduced ex ante transaction costs. If the public buyer is corrupted or seeks to favor a particular firm, then the adapted procedure is purely inefficient. If the public buyer uses an adapted procedure to save on ex ante transaction costs, one would have to balance the ex ante transaction costs with the ex post outcomes of procedures to conclude on whether increasing discretion in public tenders is, on average, beneficial. The implication of our result in terms of policy is that a procedure that would enable to avoid the trade-off between a loss in efficiency through the selection of less efficient firms and high ex ante transaction costs could improve the overall efficiency of public procurement. Such procedure would preserve a high degree of competition between firms and at the same time involve low ex ante costs and barriers to entry.

The rest of this chapter is organized as follow. In section 3.2, we review the related literature. In section 3.3, we present the institutional framework. In section 3.4, we describe the data. In section 3.5, we present the empirical strategy. In section 3.6, we present the main results, before assessing their robustness. We open a discussion in section 3.7. Finally, we draw a conclusion in section 3.8.

3.2 Literature

This chapter contributes to extend the strand of the literature related to the question of whether discretion should be increased in public procurement. Overall, this literature uses contract outcomes (price rebates, delays, renegotiations...) as a measure of efficiency of different kinds of selection procedures involving different levels of discretion.

On one side, the conventional view is that open auctions are an efficient mechanism for selecting firms because they make the selection of the lowest cost bidder more likely, thereby reducing the winning price. Using a standard auction model, Bulow and Klemperer [1996]

shows that a simple auction almost always yields a better outcome than a negotiation with fewer firms. However, as Goldberg [1977] argues, when complex transactions are likely to be subject to unexpected events, awarding a contract through negotiation may be more desirable than through auctions. Manelli and Vincent [1995] illustrates the benefit of negotiation over open auctions under certain circumstances. In particular, when non-contractible quality dimensions of the procured good are important. Therefore, the choice of award mechanism is likely to be subject to a trade-off between transparency and lower ex ante price on the one hand and ex post performance on the other hand.

An extensive empirical literature has been dedicated to assessing the performance of auctions and alternative procedures in public procurement. This literature emphasizes the merit of the introduction of some discretion in selection procedures. It shows some evidence that increasing discretion improves ex post contract performance. Cameron [2000] tests for the potential existence of a compromise between price and ex post performance using a dataset of long-term power contracts electric utilities have awarded in the United States. It finds that increasing discretion through allowing a more subjective evaluation of bids as well as post bid negotiations (compared to rigid competitive bidding procedures) yields a price reduction of 18% but also an increase in the probability of contract breach by more than 50%. Coviello et al. [2017] analyzes the effect of increased discretion - measured in terms of whether the buyer can decide who to invite to bid or not - over ex ante and ex post procurement outcomes using a dataset of public tenders in construction in Italy. Using a regression discontinuity design, it finds, using its main sample, that increased discretion has no effect on ex ante auction outcomes (number of bidders, rebates, size of the winners, distance of the winner from the public buyer) and on most of their ex post performance measures (duration of the works, monetary renegotiations). In a closer neighborhood of the discontinuity threshold, it finds that the positive effects of discretion may dominate the negative ones. Discretion is likely to reduce the total duration of works, to lead to the selection of larger firms and to a reduction in the number of firms submitting bids, thereby saving costs associated to bid screening. However, a higher level of discretion is found to have no significant effect over other outcomes such as the winning rebate, cost

overrun and the probability that the project is awarded to a local firm.

Another important dimension of discretion is that it may facilitate the establishment and use of relational contracts (long-term relationships) and reputational mechanisms, which can contribute to complement incomplete contracts. As discussed by Spagnolo [2012], *"there are several reasons why complementing explicit contracts with reputational mechanisms based on ex post evaluations of contractor performance may improve the governance of procurement transactions. These are linked to the inability of explicit contracts to describe or of the court system to verify important aspects of the procurement transactions at reasonable cost, but also to the high costs of enforcing explicit contracts through litigation"*. This aspect is confirmed by Coviello et al. [2017] which finds that increased discretion makes an incumbent more likely to be awarded the contract when renewed. Its results suggest that incumbents are more likely to be renewed if they had better performance in the past than the average (in terms of delay), and that their selection yields better than average performance when renewed.

Finally, another potential dimension of increased discretion through the possibility to restrict the number of bidders is also shown to be beneficial to the buyer in non-complex contracts by reducing the costs related to the selection of the supplier. Chever et al. [2017] demonstrates that the restriction of competition for small value contracts aims at sharing out contracts among pre-qualified firms of good repute and does not result in higher prices. Overall, its results suggest that restricted auctions, while saving on transaction costs, preserve a high level of competition between the 'happy few' firms selected to bid.

However, discretion could be detrimentally used by a public authority to favor a particular firm and reap off some personal benefits. Open auction is indeed seen as an instrument that keeps buyers accountable by limiting their discretion in the allocation of public funds. Palguta and Pertold [2017] observes that, in Spain, increased discretion through the possibility to preselect potential bidders makes firms with anonymous untraceable owners more likely to win the contract. On the opposite, Bandiera et al. [2009] exploits a policy experiment in the Italian public procurement system and concludes that public buyers

endorsed with more discretionary power are more efficient and are not more corrupt than more regulated ones, thereby generating less waste overall. It shows that administrative inefficiency (e.g. buyer's lack of skills or excessive regulatory burden) appears to be a more important source of waste than corruption.

To sum up, the literature shows that open auctions which leave no room for discretion lead to lower prices than procedures involving some forms of discretion. However, increased discretion enables to lower ex ante screening costs when contracts are simple and is likely to reduce ex post renegotiation costs when contracts are complex and likely to be incomplete. Concerning corruption, evidence is mixed as to whether discretion fosters corruptive behaviors.

Unlike most studies focusing on outcomes of discretion in public procurement, our efficiency measure is not one or multiple dimensions of the contract outcome. Instead, we use the productivity of the selected firm. We believe that the productivity measure reflects the ability of the firm to meet the terms of the contract at the best price and/or the best quality. It can be thought of as an indirect measure of price and quality. The closest work to ours, Baltrunaite et al. [2018], also focuses on the supplier selection side and productivity. Even though our papers share some similarities, there are two main differences. First, our definition of discretion is broader since it is not limited to negotiation. Indeed, in France, the buyer may be granted some discretionary power in terms of, for example, restriction of competition, deadline to receive the offers, and publicity support. Second, the identification strategy differs, since we do not compare the outcomes of a tender before and after a reform, but instead use a two-step procedure where we first assess the determinants of the adoption of an award procedure where discretionary power is allowed, and second we determine to which extent the use of such a procedure makes the selection of an efficient supplier more likely.

3.3 The institutional context

The French law on public procurement is primarily based on the European Union procurement directive[1]. To mitigate the risk of corruption in public procurement, the European Commission (EC) sets value thresholds (see Table 3.1 for information on thresholds) above which public authorities must use formal procedures, which consist of open auctions without negotiation. The use of negotiated procedures is not allowed, except in certain specific cases set by the EC. For every contract below these thresholds, national laws apply while still respecting the pillar principles set by the EU, namely equal treatment, non-discrimination and transparency.

Table 3.1: Public procurement thresholds for sub-central contracting authorities (2006-2015)

	Supplies and services (€)	Public works (€)
2006-2007	210 000	5 270 000
2008-2009	206 000	5 150 000
2010-2011	193 000	4 485 000
2012-2013	200 000	5 000 000
2014-2015	207 000	5 186 000

In France, public buyers may in this case use what is called an adapted procedure (*procédure adaptée*). Its main objective is to give a high degree of discretion and flexibility to the buyer in order to find out the most efficient way to procure goods and services of low to moderate value. In this procedure, *"ways and means are freely chosen by the public buyer and should adapt to the nature and characteristics of the needs, the number or location of firms that are likely to participate to the tender, and to the circumstances of the procurement"*[2]. The buyer is in particular free to define the advertising and competitive processes that are the most proportionate to the purpose, amount and circumstances of the purchase

[1] As our procurement data cover the period from 2006 to 2015, our institutional framework is based on the EU Directive 2004/18 of March 31, 2004, as well as on the 2006 French Code for public procurement. We are not concerned with the new European Directives on Public Procurement voted on in 2014 (2014/24/UE and 2014/25/UE) and adopted into French law in 2016.

[2] Article 28 of the French Code for public procurement. Translation from French by the Authors.

(see Table 3.2 for a detailed presentation of the characteristics of this procedure, as well as a comparison with the open auctions procedure).

The main benefits of this procedure are the possibility to directly negotiate, the possibility to adjust the deadlines to the constraints (nonexistence of a minimal number of days to submit an offer), the possibility of not specifying ex ante the weights associated to selection criteria, the possibility to choose the most appropriate publicity support, a freedom of choice regarding the contracting formalism, and the possibility to directly contact the firms to submit an offer. In addition, public buyers have the possibility to select the contractor based on its experience. It is noteworthy that, in case of negotiation, the buyer has the possibility to restrict competition to a limited number of candidate firms. It is even encouraged to do so since negotiating with too many candidates is a waste of time and thereby, a cost. It is estimated that it is difficult for a small public buyer to directly negotiate with more than two or three candidates[3]. The restriction of competition to a pool of bidders should be notified in the call for tenders.

This flexibility should lower the administrative burden of organizing a tender, thereby resulting in lower ex ante procurement costs compared to the rigid open auction procedures. The other ambition of this procedure is to facilitate the access of firms that are less able to participate to tenders above the formal thresholds, in particular new entrants and SMEs. Indeed, formalized procedures require a three-year balance sheet of bidding firms, a document that new entrants are unable to provide. On the opposite, the adapted procedure accepts a simple official bank statement. Additionally, new entrants and SMEs are often not familiar with formal procedures, resulting in disproportionally high costs for them. Finally, it is recommended that the public buyer does not ask for an excessive number of documents, in particular to SMEs.

It is noteworthy that, below the formal thresholds, the authority is not compelled to use an adapted procedure. It has the possibility of using a formal one. In practice, below the

[3]Direction des Affaires Juridiques (French Legal department), Les marchés à procédure adaptée, available at: https://www.economie.gouv.fr/files/directions_services/daj/marches_publics/conseil_acheteurs/fiches-techniques/mise-en-oeuvre-procedure/marches-procedures-adaptees.pdf

Table 3.2: Main characteristics of the adapted and the open auction procedures

	Adapted procedure (*procédure adaptée*)	**Open Auction**
EU Threshold	Below.	Below or above.
Is negotiation possible ?	Yes (but not mandatory), over **all** aspects.	Not possible on any aspect.
Publicity	- If the value of the contract <90,000€: mandatory, but publication is not. Free choice of publicity support. - If the value of the contract >90,000€, should be published in an official	Should always be published in an official journal.
Consultation documents	Could be limited to the main characteristics of the awarding mechanism, to the condition of the negotiation, and to the selection criteria of the submitted tenders. The redaction of technical specifications is not mandatory, but	Very detailed and specific.
Submission deadline	Free choice.	Minimum of 52 days.
Proof of the firm's financial capabilities	Not mandatory. The participation of new firms (less than 3 years) is possible since they can provide a bank statement rather than a three-year balance sheet.	At least the turnover from the past three years.
Candidates' experience	Can be requested.	Cannot be requested.
Weighting of awarding criteria	Not mandatory.	Mandatory.
Restricted pool of candidates	Possible.	Not possible.
Awarding commission	Not mandatory.	Mandatory.
Immediate notification to the rejected participants	Not mandatory.	Mandatory.
Standstill[1]	Not mandatory.	Minimum of 16 days.
Publication of the award notice	Not mandatory.	Mandatory.

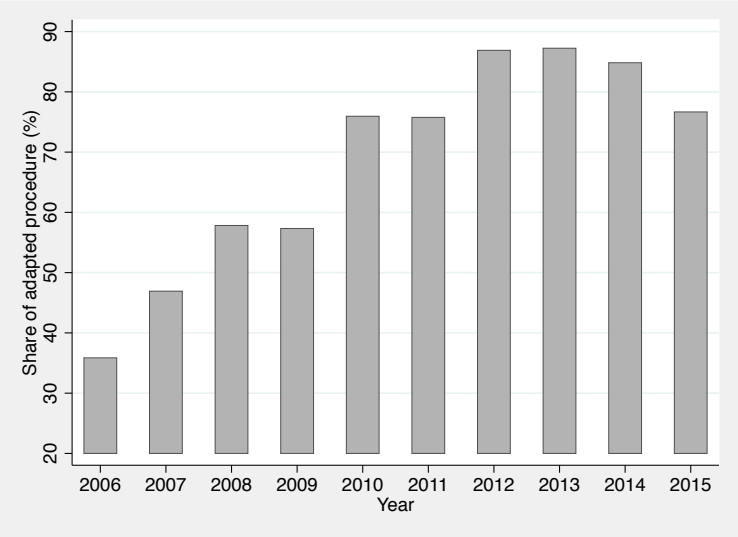
[1] The standstill is a suspensive deadline between the announcement date of the awarding notice and the signature of the contract. It allows for the rejected candidates to contest the ways the awarding process was conducted.

Source: Legifrance, Circulaire du 29 décembre 2009 relative au Guide de bonnes pratiques en matière de marchés publics, 2009, available at: https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000021570204
Direction des Affaires Juridiques, Les marchés à procédure adaptée, 2015, available at: URLhttps://www.economie.gouv.fr/files/directions_services/daj/marches_publics/conseil_acheteurs/fiches-techniques/mise-en-oeuvre-procedure/marches-procedures-adaptees.pdf
EDT, Vade-Medum MAPA, 2010, available at: http://www.achatpublic.info/sites/default/files/document/documents/guide_MAPA_ETD_1.pdf?from=base-documentaire&page=228

European Union thresholds, French municipalities use both the adapted procedure and the open auction one. As the former is considered less costly for simple contracts, we should observe only this type of award procedure below formal thresholds (if we strictly refer to an economic point of view).

However, it appears that public buyer often opt for a formal procedure instead of an adapted one by fear of any legal risk[4]. The adapted procedure was first introduced in 2004, and it has been increasingly used since (see Figure 3.1). Whereas they accounted for less than 40% of award procedures for contracts below the EU thresholds in 2006, adapted procedures represented almost 80% of them in 2015 at the municipal level.

Figure 3.1: Share of adapted procedures for contract below the EU thresholds in French municipalities (2006-2015)



Note: Share of adapted procedures over the total number of award notices at the municipal level for contracts below the EU formal thresholds.

First, the adapted procedure entails much greater legal uncertainty than open auctions. The procedural flexibility associated with this procedure is limited by the pillars set by the EC, namely transparency, freedom of access and equal treatment of candidates. Given the flexibility allowed by the procedure, it is very difficult for public buyers to be sure to be

[4]EDT, Vade-mecum Mapa, available at: http://www.achatpublic.info/sites/default/files/document/documents/guide_MAPA_ETD_1.pdf?from=base-documentaire&page=228, 2010.

compliant with these obligations. For example, the adapted procedure allows a negotiation phase. At the drafting stage of the consultation document, the question for public buyers is whether the modalities under which the negotiation is going to take place are defined precisely enough to comply with the principles of public procurement. Public buyers may wonder whether it is possible to specify only that negotiation is going to be allowed or whether they should precisely define the modalities of the negotiation. During the negotiation, other questions arise such as how to ensure the traceability of the exchanges between the companies and the buyer. Once the selection of the operator has been made, the period before the signature of the contract is also a source of great uncertainty for buyers because the case law is unclear whether a time limit between the notification to unsuccessful candidates and the signature of the market should be respected. Because of the legal uncertainty associated with the adapted procedures, some buyers prefer to resort to open auctions to avoid the risk of legal claims and associated costs (Spiller [2008]; Chong et al. [2014]). The challenging of contracts before a court is costly and time consuming, and may cause the elected official to leave its public position and to be prosecuted (Spiller [2008]). Second, public buyers could feel reluctant to use the adapted procedure to avoid suspicions of corruption. The adapted procedure indeed introduces discretion at several stages of the procedure, from the advertising stage to the choice and notification of the operator. Spiller [2008] shows that when a third party competes with the public buyer in another political market, the former may behave opportunistically by challenging the probity of the latter. In this case, the buyer may favor selection procedures and contracts leaving no room for discretion.

3.4 Data

3.4.1 Datasets

This study combines data from several datasets. Measures of productivity of firms were computed using the Amadeus database, which contains financial information on European firms. They were then matched with a database of both calls for tenders and award notices

of public procurement contracts from 2006 and 2015[5].

Amadeus

We compute labor productivity and total factor productivity (TFP) using the Amadeus database. Amadeus is a firm-level database compiled by Bureau van Dijk which contains financial information on European firms. It includes all the balance sheets and P&L items, such as value-added, turnover, total assets, intangibles assets, etc. over a period of ten years for each firm. We compute TFP focusing on companies of a certain minimum size, that is discarding companies of operating revenue below EUR 1 million, total assets below EUR 2 million, or number of employees below 15. The reason is that we do not have access to data on these small companies.

The original dataset includes 2,612,450 observations and contains identifiers to track firms over time between 2006 and 2015. Key variables such as employment and materials are often missing in the database because private firms are not required to report them. The sample size is hence reduced by keeping only firm-year observations which contain the relevant variables to estimate production functions. It is further reduced by performing the following operations. We deleted firm-year observations with negative or zero value-added and materials and negative values of capital defined as tangible assets, number of employees and wages. We removed firm-year observations with extreme variations in ratios between production function variables (capital stock per employee and value-added per employee in the 1^{st} or 99^{th} percentiles). We removed firms with growth rate of value-added, material, labor and wages greater than 500%, 200%, 200% and 200% respectively. We also replaced firm-year observations in the 1^{st} or 99^{th} percentiles of their distributions with missing values. At the end, we removed the top and bottom 1% of the productivity distribution and re-estimated the productions functions without these extreme observations.

In the end, we are left with a ten-year unbalanced panel of 1,252,194 companies on which we estimate TFP. We observe a maximum of 142,219 firms in 2014 and a minimum of

[5]We thank InfoPro Digital for producing and gracefully offering us these data.

106,962 firms in 2006. Descriptive statistics on the sample are presented in Appendix A1.

Since the Amadeus database does not contain information on the quantities of output and inputs, TFP was computed estimating revenue-based production functions. Following the standard practice in the literature, all variables entering the production function were deflated using industry specific indices. We used indices provided in the EU KLEMS database. All these indices are specific to France and available at the two-digits NACE rev.2 level. Value-added was deflated using the gross value-added price index. Wages were deflated using an index of the compensation of employees. Capital, defined as tangible assets, was deflated using the gross fixed capital formation index and materials, which correspond to intermediate consumption, were deflated using the intermediate inputs price index.

Public Procurement

The original dataset includes every call for tenders by municipalities, associations of municipalities, counties and regions in France between 2006 and 2015 (i.e., approximately 80K observations per year). We were able to collect award notices (name of the selected company) only for a sub-sample of contracts (i.e., for approximately 14K observations per year).

For each tender, the dataset provides information on the identity of the winner and its final bid, the procedure and criteria used to select the winner (award mechanism), the number of bidders, the object of the tender, the sector of the tender (supplies, work, etc.) and the identity of the buyer. It contains public tenders relative to all goods and services that are bought by municipalities, associations of municipalities, counties and regions. The range of goods and services the public buyer deal with is very broad, as is the range of contract values.

The identity of the firm that won the tender is used, along with the information on its location, to match this data together with the Amadeus database in order to get the measures of productivity of the winning contractor, as well as other relevant financial

information.

3.4.2 Variables

Variable of interest

The database contains two main types of award mechanisms, open auctions and adapted procedures. Hence we create a dummy variable that takes the value of one if a public buyer decided to award the contract through an adapted procedure and zero if it chose an open auction. This variable, *adapted procedure*, is the variable of interest throughout the analysis.

Outcomes

We measure the outcome of the awarding procedure using both labor and total factor productivity. Labor productivity is computed by dividing value-added by the number of workers. Value-added corresponds to sales from which materials are deducted so that our measure of efficiency is not influenced by the purchase of intermediate inputs. If sales were used instead, labor productivity would indeed rise simply because of a firm buying more material per worker. Total factor productivity is computed by estimating production functions relating output to inputs of firms at the industry level, using the approach of Levinsohn and Petrin [2003] (and the approach of Wooldridge [2009] as a robustness check). More information on the estimation of production functions is given in Appendix A2.

The outcome variables do not consist in absolute measures of productivity of firms. We are rather interested in comparing the productivity of the selected firms with the productivity of firms within the same industry at a given time. We hence define relative measures of productivity, where the productivity of a firm is compared to the distribution of productivities of firms that belong to the same industry (defined at the broad NACE Rev.2 level presented in Table 18) in a given year.

The measure of the relative efficiency that we use is the proportional distance of a firm from the technological frontier, measured by the productivity of the firm with the highest TFP within an industry by year. This measure was proposed by Aghion et al. [2015] to compute a technological spread within each industry. Formally, we compute:

$$m_{it} = (TFP_{Ft} - TFP_{it})/TFP_{Ft} \tag{3.1}$$

where F denotes the firm with the highest TFP in the industry in year t and i denotes nonfrontier firms. $0 \leq m_{it} \leq 1$ and $m_{Ft} = 0$. Note that depending on the distribution of TFPs within an industry and at a given year, the average of m_{it} across all firms in the industry can be either low, which indicates that in this industry firms are technologically close to the frontier or high, which indicates a large technological gap with the frontier.

Control variables

The regressions include some control variables to account for the characteristics of the industry, the buyer, and the contract.

First, since our relative measure of efficiency m_{it} is industry and year specific, we control for the industry of the winning firm by including dummies corresponding to the broad NACE Rev.2 levels presented in Table 18 in Appendix A2 and for year fixed effects.

Second, we account for some observable characteristics of the buyer. We consider its type (whether it is a region, a county (French *département*), a municipality or a group of municipalities) through the variable *buyer type* , its size, represented by the population (*Population*), and its experience toward public procurement in general, as measured by the total number of tenders organized by the buyer in the past year (*Experience*). To control for the time-invariant characteristics of the buyers, one strategy would be to include buyers fixed effects in the regressions. However, doing so would eliminate the variation in our data. It also implies including a very large number of fixed effects in the regressions (more than 1000), which can be problematic in nonlinear models (incidental parameter problem). Additionally, we believe that characteristics of buyers which are likely to affect

procedure and firm selection are likely to be time- and contract-specific (a buyer favors the incumbent for a given contract or has no expertise in a given industry). We hence do not include buyers fixed effects in the analysis.

Third, we control for contract-specific characteristics such as the sector of activity of the contract (*Sector*) which is divided between public works, services, supplies, and expertise in our dataset, the expected number of participants to the tender (*Expected number of bidders*), defined for each buyer as the average number of bidders participating to a tender during the past year in a particular category of project (CPV[6] level). We also account for the number of divisions of the contract[7] (*Number of divisions*), which is determined by the buyer when the tender is designed, even if public procurement rules encourage maximal division of the contract. Finally, we also control for the total value of the contract (*Total value*) and the value of the relevant division (*Division value*). Note however that these values do not correspond to ex ante estimations of the values of the contracts by the buyers but to winning bids. They are therefore likely to be affected by the selection procedure, hence being bad controls. Contrary to many countries where the buyer's initial cost estimates are provided in the calls for tender (e.g. in Italy), this information is not publicly available in France. Since we do not have other measures of the values of the contract, we include them in some regressions to see their effect on the coefficient of interest.

3.4.3 Descriptive statistics on the estimation sample

The final sample is restricted to tenders with contract values that are under the EU formal thresholds. Indeed, to award these contracts, public buyers have the possibility to choose between an adapted procedure, that give them some level of discretionary power, and an open auction, that is strictly regulated and supposedly leaves no room for discretion. Thresholds depend on the object of the tender (public works or not). They are presented

[6]The common procurement vocabulary (CPV) establishes a single classification system for public procurement aimed at standardizing the references used by contracting authorities and entities to describe procurement contracts.

[7]We use the terminology of Bajari et al. [2009]. In Europe, division of contracts are also designated by the term *allotment*.

in Table 3.1 by sector and period of time. The final estimation sample contains 7,396 observations, with each observation corresponding to a given contract awarded to a specific firm for which we have at least a value of TFP.

Table 3.3 shows that the range of industries of firms included in the sample is very broad, with 59% of observations in the construction industry, 11% in manufacturing, 11% in wholesale and retail trade; repair of automobile and motorcycles, and 9% in activities of administrative and support services. The adapted procedure is used in 51% of tenders in the construction industry, 39% in manufacturing, 40% in trade, repair of automobile or motorcycles and 37% in activities of administrative and support services. Mean total value of tenders are particularly high in construction (€786, 465), when compared, for example, to the manufacturing industry (€504, 729). This fact is not surprising given that firms belonging to the construction industry are more likely to win tenders classified as public works, for which the thresholds authorizing the use of adapted procedures are higher than in other sectors. The average technological gap (measured as the mean of the distances to the productivity frontier) ranges from 0.81 in the activities of administrative and support services industry to 0.39 in the agriculture, forestry and fishing industry. In the former, the technological gap between companies within the industry is high, while it is much lower in the latter.

Table 3.3: Sector distribution - Main estimation sample

Sector	Number of obs.	Share of sample	Share of adapted procedure	Mean total value of tender	Mean relative TFP
Accommodation and catering	24	0.00	0.42	86,707	0.46
Activities of administrative and support services	648	0.09	0.37	589,787	0.81
Agriculture, forestry and fishing	32	0.00	0.22	279,479	0.39
Arts, entertainment and recreation	54	0.01	0.61	251,207	0.72
Construction	4377	0.59	0.51	786,465	0.75
Education	12	0.00	0.92	99,438	0.71
Financial and insurance activities	34	0.00	0.29	115,953	0.56
Information and communication	86	0.01	0.38	135,249	0.69
Manufacturing industry	790	0.11	0.39	504,729	0.71
Other service activities	22	0.00	0.55	93,996	0.62
Specialized, scientific and technical activities	288	0.04	0.50	173,391	0.78
Trade, repair of automobiles and motorcycles	835	0.11	0.40	200,843	0.61
Transport and storage	95	0.01	0.32	115,754	0.74
Water production and distribution, sanitation, waste management and pollution	99	0.01	0.34	194,981	0.47

Table 3.4 presents summary statistics on the main variables of the analysis. 46% of tenders award the contract using an adapted procedure, as opposed to an open auction. The average distance to the frontier amounts to around 0.73 (m_{it} TFP). The average value of divisions is €146,622 and the average total value of tenders is €610,416.

Table 3.4: Sector distribution - Main estimation sample

Variable	Number of obs.	Mean	Std.dev.	Min	Max
Adapted procedure	7,396	0.46	0.50	0.00	1.00
Number of divisions	7,396	5.39	4.73	1.00	19.00
Experience	7,396	132.09	124.36	1.00	858.00
Division value (euros)	7,396	146,621.81	296,773.25	1,000.00	4,960,000.00
mit TFP	7,396	0.73	0.10	0.09	0.87
Expected number of bidders	4,284	4.84	4.29	1.00	71.00
Population	7,396	111,509.41	157,622.19	54.00	861,676.00
Prevalence	7,396	0.61	0.23	0.00	1.00
Total Value (euros)	7,396	610,416.31	889,048.31	25,162.69	5,229,553.00

Table 3.5 compares the average values of the main variables of the analysis for tenders awarded through adapted procedures and tenders awarded through open auctions. The

expected number of bidders, the population, and the experience of the buyer constitutes variables that are fairly similar across groups. What differs the most are the total value of tenders and the value of divisions, which are both much higher when open auctions are resorted to. The average relative productivity of the selected firm (m_{it} TFP) is similar across the two groups. The test of the null hypothesis of no difference in productivity between the two types of procedures is reported in Table 3.6. Results support the hypothesis that open auctions select more efficient firms than adapted procedures. This analysis does not control for projects observable characteristics which differ across the subsample of projects awarded through open auctions and those awarded through adapted procedures. It also does not take into account buyers characteristics that influence both procedure and supplier selection.

Table 3.5: Comparison of tenders with adapted procedure and open auction

	Adapted procedures Mean	**Open auctions** Mean
Division value (euros)	116,264.41	172,876.45
Expected number of bidders	4.51	5.15
Experience	120.78	141.87
Number of divisions	5.27	5.49
Population	121,179.05	103,146.63
Prevalence	0.69	0.53
Total Value (euros)	473,750.28	728,612.13
mit TFP	0.74	0.72

Table 3.6: Test of differences in relative TFP means

	Mean(Open_auction)	**Mean(Adapted_procedure)**	**Diff.**	**Std.Error**
mit (TFP)	0.72	0.74	-0.02^{***}	0.0023

3.5 Empirical strategy

We empirically test whether the use of an adapted procedure makes the selection of a more efficient firm more likely than the use of an open auction mechanism. The ideal experiment would be to assign selection procedures randomly to contracts and compare the productivity of the firms selected with each type of procedure. The model we want to

estimate is the following:

$$Y_{ibt} = \alpha + \beta adapted_procedure_{ibt} + \delta' X_{ibt} + \epsilon_{ibt} \tag{3.2}$$

where Y_{ibt} is the relative productivity of the selected firm in tender i organized by buyer b in year t, $adapted_procedure_{ibt}$ is a dummy variable equal to one if the award procedure is an adapted procedure and zero if it is an open auction, X_{ibt} are a set of controls including year and industry fixed effects, ϵ_{ibt} is an error term and α, β and δ are parameters to estimate, with β the effect of using an adapted procedure.

Estimation of equation 3.2 allows controlling for a number of observable characteristics of buyers and contracts which are likely to impact both the award procedure and supplier selection such as the sector of the tender (public works, supplies) or the experience of the buyer with tenders.

However, estimating our specification through OLS would yield biased estimates of the coefficients in the regression as some unobserved factors, in particular unobserved characteristics of the buyer and of the contract, might influence both the choice of the award mechanism and of the supplier, resulting in omitted variables. More specifically, these unobserved factors will likely be buyer-specific, like the presence of corruption or favoritism, knowledge of the industry or the capability of the buyer to select an efficient supplier.

To address this issue, our strategy is to instrument the award mechanism. A good instrument must fulfill two conditions. First, it must be related to the endogenous explanatory variable. Second, it should not be correlated with the unobserved factors mentioned above (corruption, favoritism, effort, skills, etc.).

3.5.1 Identification

Our explanatory variable of interest *Adapted procedure* is likely to be correlated with factors that we are not able to observe and that are buried in the error term of equation

3.2, potentially leading to an omitted variable bias in the OLS regression.

In particular, we might not be able to consider specificities of the buyer that may influence the decision to use an adapted procedure and the selection of a firm, such as its experience and skills. For example, if the public buyer is bribed by an inefficient firm, something that we do not observe, it will be more likely to use an adapted procedure as it gives a higher degree of discretion, thereby facilitating corruptive behavior. As a consequence, the OLS estimate is likely to suffer from an upward bias. On the contrary, a downward bias might be caused by the public buyer having no knowledge about a particular industry and consequently choosing to use an open auction and at the same time selecting a low-productive firm. Therefore, the direction of the potential bias we might face is ambiguous.

The instrument should be correlated with the choice of the award procedure but should not influence whether the selected firm is relatively more productive than firms belonging to the same industry, other than through the procedure. We construct an instrument that draws on Guasch et al. [2007][8]. Our instrument is the share of adapted procedures used by different buyers in the three months before the tender (*Prevalence*)[9]. The construction of the variable excludes the share of adapted procedures of the public buyer we consider. It also only accounts for public buyers located in the same county as the one we consider. For each tender, we hence compute the share of adapted procedures in tenders in the same county, in the last three months before the launch of the tender, while excluding the share of adapted procedures of the buyer considered[10].

Since our regressions all include year fixed effects, identification comes from the variations of the instrument *Prevalence* between counties in given years. Figure 3.2 shows that there

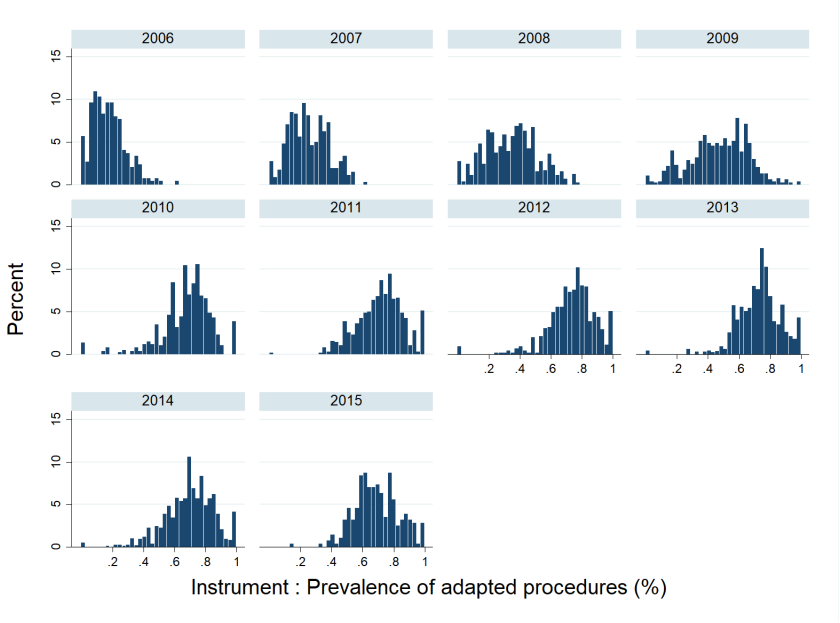
[8]Guasch et al. [2007] instruments specific contract clause in procurement using *"the average prevalence, at the time of contracting, of the same clause in the same sector and in different countries (Instrument 1) and in different sectors and different countries (Instrument 2)"*. The rational for Instrument 2, that is for looking at different sectors, is because some operators might be present in the same sector in different countries, thereby introducing some correlation through operator-specific effects. Since we are not worried by firm-specific effects in our specification, we do not make a distinction by sector.

[9]Results are robust to the use of shorter or longer lags.

[10]The exclusion of the share of adapted procedures of the buyer and the use of lagged values of shares of adapted procedures in tenders is an attempt to mitigate the reflection problem raised in Manski [1993].

is heterogeneity between counties in the shares of adapted procedures in each year.

Figure 3.2: Distributions of the instrument by year (2006-2015)

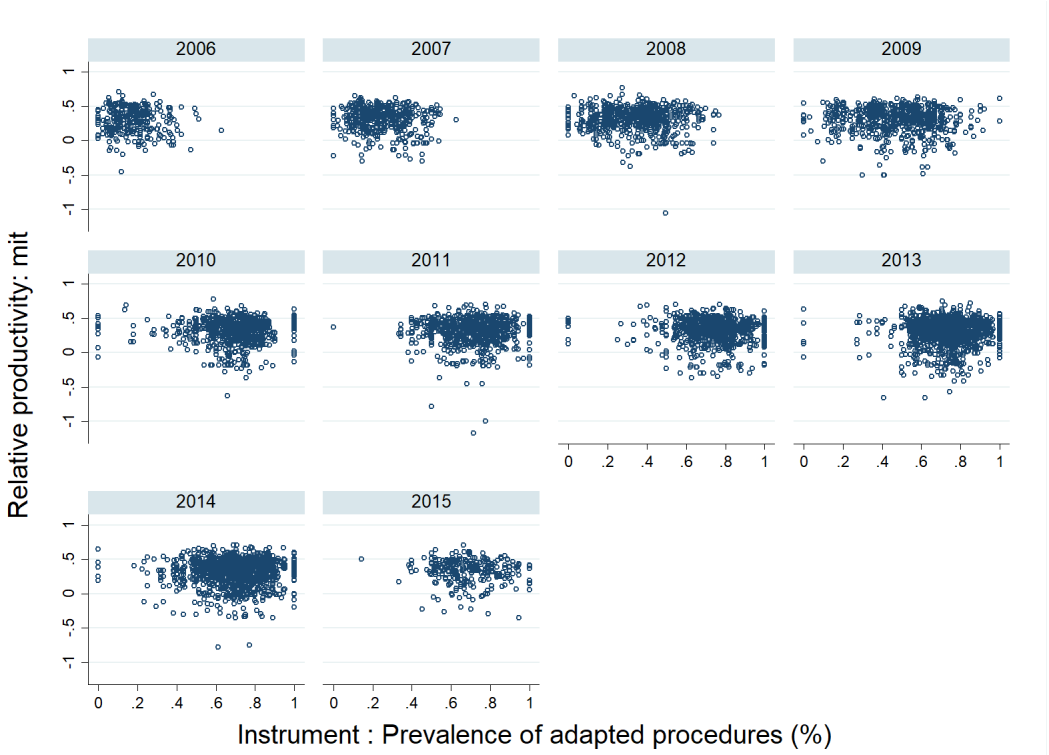


If these variations between counties are not exogenous to variations in productivities, identification is undermined. To confirm that we should not expect any systematic correlation between our measure of productivity and the instrument, Figure 3.3 plots, by year, the relative productivities (m_{it}) of selected firms against the instrument. It illustrates that the share of adapted procedures is not systematically associated with productivity. Recall that the endogeneity concern comes from the correlation between procedure choice and unobserved variables that are likely made of buyer-specific and contract-specific effects. The validity of the instrument is further confirmed by the fact that the choice of a procedure is correlated across different buyers in the same county through some aspects that are independent of buyer- or contract-specific effects. One example would be the existence of a spill-over effect over buyers in close by geographical areas due to common reasons for the adoption of the adapted procedure, such as the publication of a guidebook on how to use the adapted procedure[11]. According to Kelman [2005], public buyers are prone to

[11] An example is the guidebook of adapted procedure, published by the county Somme in 2011. This guidebook is likely to make buyers located in this county understand better the adapted procedure and hence use it more, independently of their characteristics or of contract-specific characteristics.

resist change so that new procedures such as the adapted procedure may take time to be adopted.

Figure 3.3: Productivity and share of adapted procedures



3.5.2 Two-step estimation

The causal model of interest is given in equation 3.2, where $adapted_procedure_{ibt}$ is a dummy variable for the award procedure used in tender i organized by buyer b in year t. The variable of interest is a dummy endogenous variable. The 2SLS first stage is equation 3.3, a linear regression of $adapted_procedure_{ibt}$ on a constant, covariates and a vector of instruments, Z_{ibt}.

$$adapted_procedure_{ibt} = \pi_0 + \pi_1' X_{ibt} + \pi_2' Z_{ibt} + \xi_{ibt} \tag{3.3}$$

Because $adapted_procedure_{ibt}$ is a dummy variable, the conditional expectation function

associated with the first stage is nonlinear and should be estimated using a nonlinear model such as a logit model. Therefore, the procedure to estimate the model must be implemented in two steps to avoid the risk of biasing the estimation with an incorrect nonlinear first stage (see Angrist and Pischke [2009] and Wooldridge [2009]). The procedure consists first in estimating equation 3.3 by using a logit, then in using the predicted value $\widehat{adapted_procedure_{ibt}}$ as an instrument for $adapted_procedure_{ibt}$ in equation 3.2 in a conventional 2SLS-IV procedure.

Identification comes from the fact that the vector of instruments Z_{ibt} is correlated with the endogenous dummy variable but has no effect on the outcome other than through the choice of the award procedure. The regressions also control for additional explanatory variables, which potentially impact procedure and firm selection. These explanatory variables are included both in the logit regression which estimates equation 3.3 and in the conventional 2SLS procedure that estimates equation 3.2 (both in the first-stage and in the equation of interest).

We can now rewrite equation 3.3 as follow:

$$\begin{aligned} adapted_procedure_{ibt} \quad = \quad & \pi_0 + \pi_1 Prevalence_{bt} \\ & + \pi_2 ln(population)_{bt} + \sum_{s=2}^{6} \pi_{3s} buyer_type_{sbt} \\ & + \pi_4 ln(experience)_{bt} + \pi_5 ln(number_of_divisions)_{ibt} \\ & + \sum_{p=2}^{4} \pi_{6p} Sector_{pibt} + \pi_7 ln(expected_participation_{ibt}) \\ & + \sum_{p=2}^{19} \pi_{8p} Industry_{pib} + \sum_{j=2007}^{2015} \pi_{9j} d_j + \xi_{ibt} \end{aligned} \tag{3.4}$$

and equation 3.2 as:

$$Y_{ibt} = \alpha + \beta adapted_procedure_{ibt} + \delta' X_{ibt} + \epsilon_{ibt} \tag{3.5}$$

where X_{ibt} includes all the variables of equation 3.4 but the instrument $Prevalence$. We estimate equation 3.4 with a logit model and obtain predicted values of $adapted_procedure_{ibt}$ ($\widehat{adapted_procedure_{ibt}}$). We then use this variable as an instrument for $adapted_procedure_{ibt}$

in a conventional 2SLS-IV procedure.

Standard errors are likely to be correlated over firms in equation 3.5, hence standard errors are clustered at the firm level. The clustered standard errors shown in the Tables of the chapter are the standard errors reported by Stata in the IV-2SLS estimations. As explained in Wooldridge [2009][12], the usual 2SLS standard errors and test statistics are indeed asymptotically valid in our two-step procedure[13].

3.6 Results

3.6.1 Determinants of the choice of a procedure

Table 3.7 provides results from estimating the likelihood of adopting an adapted procedure using a logit regression. Each column represents the first-stage estimates of different specifications over the sample used in the second step estimation.

[12] Page 623.

[13] We also computed standard errors using a bootstrap procedure. The standard errors obtained, which are not reported in the chapter, were slightly lower than those reported in the chapter.

Table 3.7: First-stage regressions

	(1)	(2)	(3)	(4)	(5)
Prevalence	0.936***	0.942***	0.955***	1.125***	0.980***
	(0.177)	(0.177)	(0.178)	(0.182)	(0.239)
ln(Population)	0.015	0.015	0.012	−0.011	0.055
	(0.032)	(0.032)	(0.032)	(0.033)	(0.043)
Type: county	−0.258***	−0.282***	−0.289***	−0.307***	−0.302***
	(0.076)	(0.077)	(0.077)	(0.080)	(0.100)
Type: region	0.570***	0.596***	0.599***	0.660***	0.803***
	(0.122)	(0.122)	(0.122)	(0.124)	(0.148)
Type: agglomeration community	−0.204**	−0.259***	−0.268***	−0.210**	−0.225*
	(0.089)	(0.090)	(0.091)	(0.094)	(0.128)
Type: municipalities community	−0.101	−0.120	−0.087	0.028	0.663***
	(0.126)	(0.128)	(0.128)	(0.134)	(0.244)
Type: urban community	−0.362***	−0.439***	−0.457***	−0.255*	−0.134
	(0.137)	(0.139)	(0.139)	(0.143)	(0.167)
ln(Experience)	−0.177***	−0.202***	−0.202***	−0.185***	−0.169**
	(0.040)	(0.040)	(0.040)	(0.041)	(0.068)
ln(Number of divisions)		−0.257***	−0.288***	−0.009	0.050
		(0.029)	(0.030)	(0.050)	(0.067)
Sector: expertise			−0.477**	−1.105***	−1.123***
			(0.218)	(0.223)	(0.317)
Sector: supplies			−0.510***	−1.169***	−1.256***
			(0.121)	(0.131)	(0.207)
Sector: services			−0.758***	−1.375***	−1.528***
			(0.119)	(0.128)	(0.198)
ln(Division_value)				−0.037	−0.005
				(0.034)	(0.045)
ln(Total_value)				−0.541***	−0.652***
				(0.043)	(0.058)
ln(Expected number of bidders)					−0.162**
					(0.064)
Constant	−3.122***	−2.913***	−2.712***	4.047***	4.034***
	(0.534)	(0.535)	(0.540)	(0.666)	(1.441)
Log-likelihood	-4264	-4224	-4200	-4002	-2316
pseudo-R^2	0.165	0.173	0.178	0.216	0.218
Obs	7396	7396	7396	7396	4278

* p < 0.1, ** p < 0.05, *** p < 0.01. Logit estimates. The dependent variable is whether the awarding procedure is an adapted procedure or an open auction. All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city and the one for the sector are public works. Robust standard errors are reported in parentheses.

The first line of Table 3.7 (*Prevalence*) shows that the correlation between the instrument and the procedure is strong and significant at the 1% level in all specifications. The prevalence of adapted procedures among buyers located in the same county as the buyer in the last three months before the tender significantly increases the likelihood to opt for an adapted procedure. In column (1), which corresponds to the regression in which we control only for observed characteristics of buyers and time and industry fixed effects, the coefficient of the instrument (*Prevalence*) is 0.936, with a standard error of 0.177. Computing marginal effects for a buyer which is a city, in year 2014, and at mean values of *Population* and *Experience* for cities in 2014 (respectively 80,532 inhabitants and 82 tenders) and with a firm in the construction industry, an increase in prevalence of adapted procedures among other buyers by 10 points increases the likelihood to choose an adapted procedure by 2.2 percentage points. When we control also for contracts characteristics, adding the number of divisions in column (3) and the sector of the contract in column (4), results are almost unchanged. Adding the values of the contract and of the division (column (5)), which, as explained in section 3.4.2, can be affected by the procedure because they represent an outcome of the procedure, and controlling for the expected number of bidders (column (6)), which reduces the sample size, does not change the results either.

We observe that factors related to the characteristics of buyers have an important role in the choice of the procedure. Buyers that are more experienced with tenders in general (*Experience*) are more likely to use open auctions than adapted procedures. This result directly corroborates Chong et al. [2014], which explains that experienced buyers use auctions more frequently because they are more able to specify the characteristics of the contract to be procured. It is also in line with Bajari et al. [2009], which explains that specialists of the construction industry argue that competitive bidding is more often used by buyers who are more experienced because the open auctions procedure is more complex. Table 3.7 also shows that regions are more likely to use adapted procedures than cities, contrary to counties and groups of cities (*Agglomeration community* and *Urban community*).

Regarding the two variables that approximate for the complexity of the contract, namely

the number of divisions and the value of the contract, we first see in Column (3) that more divided contracts are less likely to be awarded through adapted procedures than less divided contracts. In column (5), we observe that the final total value of the contract also negatively influences the likelihood of using an adapted procedure. Values of contracts are included in one specification to check whether the estimates are impacted by a proxy for contract complexity. However, we should re-emphasize that values are bad controls here because they constitute outcomes of the procedure (final bid of the winner). The number of divisions of a contract and the value of a contract are usual proxies to control for contract complexity (Bajari et al. [2009]). These results are in contradiction with the predictions of the theoretical literature and with the result of Bajari et al. [2009], according to which more complex contracts are awarded through procedures involving discretion in the private sector. A plausible explanation is that adapted procedures are promoted because they are less costly to organize than open auctions. Therefore, when buyers consider the ex ante costs associated with organizing and completing a tender, and compare it to the total cost of the project, ex ante costs represent a high share of small value contracts, leading buyers to opt for the adapted procedure. Also, this result may be driven by the need to avoid suspicions of corruption or favoritism for contracts of higher total values (Spiller [2008], Moszoro and Spiller [2012]). Our results indeed confirm the result of Chong et al. [2014] that more expensive projects are awarded via auctions, which is explained by the need to avoid suspicions of corruption or favoritism in public procurement, especially in more expensive projects.

Column (4) takes into account the sector of the tender (*Expertise*, *Supplies* and *Services*), using the public works sector as the group of reference. The use of an adapted procedure is significantly less likely for sectors others than public works. As contracts in this sector usually require specifying more dimensions and contingencies than in others, the use of an adapted procedure may therefore be helpful, particularly if there is a phase of negotiation.

Regarding the competitive environment, column (5) indicates that the higher the number of potential bidders, the lower the likelihood of using an adapted procedure (*Expected number of bidders*). This can be explained by the fact that less potential bidders make

the use of discretion more attractive (Bajari et al. [2009]).

3.6.2 Impact of the award mechanism on supplier selection (TFP of selected suppliers)

Main results

Table 3.8: Second-stage regressions

	(1) OLS	(2) IV-2SLS	(3) IV-2SLS	(4) IV-2SLS	(5) IV-2SLS	(6) IV-2SLS
Adapted procedure	0.007***	0.052***	0.059***	0.061***	0.028*	0.066***
	(0.003)	(0.020)	(0.020)	(0.020)	(0.015)	(0.020)
ln(Population)	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Type: county	−0.002	−0.000	0.002	0.002	0.001	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: region	0.004	−0.001	−0.003	−0.004	0.001	−0.008
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Type: agglomeration community	0.002	0.003	0.007*	0.007*	0.006	0.010*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: municipalities community	−0.004	−0.003	−0.002	−0.002	−0.001	−0.009
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.012)
Type: urban community	−0.012**	−0.009	−0.004	−0.004	−0.004	−0.008
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)
ln(Experience)	−0.001	0.001	0.003	0.003	0.002	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ln(Number of divisions)			0.016***	0.016***	0.013***	0.014***
			(0.002)	(0.002)	(0.002)	(0.003)
Sector: expertise				0.007	−0.002	0.014
				(0.007)	(0.007)	(0.010)
Sector: supplies				−0.010	−0.019*	0.011
				(0.010)	(0.010)	(0.017)
Sector: services				0.000	−0.010	0.010
				(0.008)	(0.008)	(0.013)
ln(Division_value)					−0.003***	−0.001
					(0.001)	(0.002)
ln(Total_value)					−0.002	0.001
					(0.002)	(0.003)
ln(Expected number of bidders)						0.001
						(0.002)
Constant	0.377***					
	(0.036)					
Obs	7396	7396	7396	7396	7396	4278
Weak identification test		103.20	104.40	120.43	183.57	99.41

* p < 0.1, ** p < 0.05, *** p < 0.01. The dependent variable is the relative productivity of the firm which was selected m_{it} . All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city and the one for the sector are public works. Column (1) is estimated by OLS and columns (2) to (6) represent the IV-2SLS estimates. The Stock-Yogo weak ID test critical values: 10% maximal IV size is 16.38. Standard errors are clustered at the firm level.

In Table 3.8, we examine the effect of using an adapted procedure on productivity. We start by estimating equation 3.5 by OLS, regressing the relative productivity of the selected firms on the procedures and controls for some observed characteristics of the buyers, as well as year and industry dummies. Column (1) shows that the adapted procedure is positively associated with the distance to the industry frontier, suggesting that adapted procedures select on average less efficient firms. The effect is small, the coefficient being 0.007 (standard error 0.003).

To infer something on the causality between procedure and supplier selection, we focus on our IV-2SLS estimates. We exploit the variation in the lagged prevalence of adapted procedures among other buyers to predict the procedure selected by the buyer. Overall, our results indicate that the adoption of an adapted procedure significantly increases the distance to the frontier, meaning that this awarding mechanism selects less efficient operators, whatever the specification. The power of the instrument is confirmed by the weak identification test, where the Kleibergen-Paap statistic is well beyond the threshold suggested by Stock et al. [2002] and Stock and Yogo [2005]. The 2SLS coefficients are positive and significant at the 10% level.

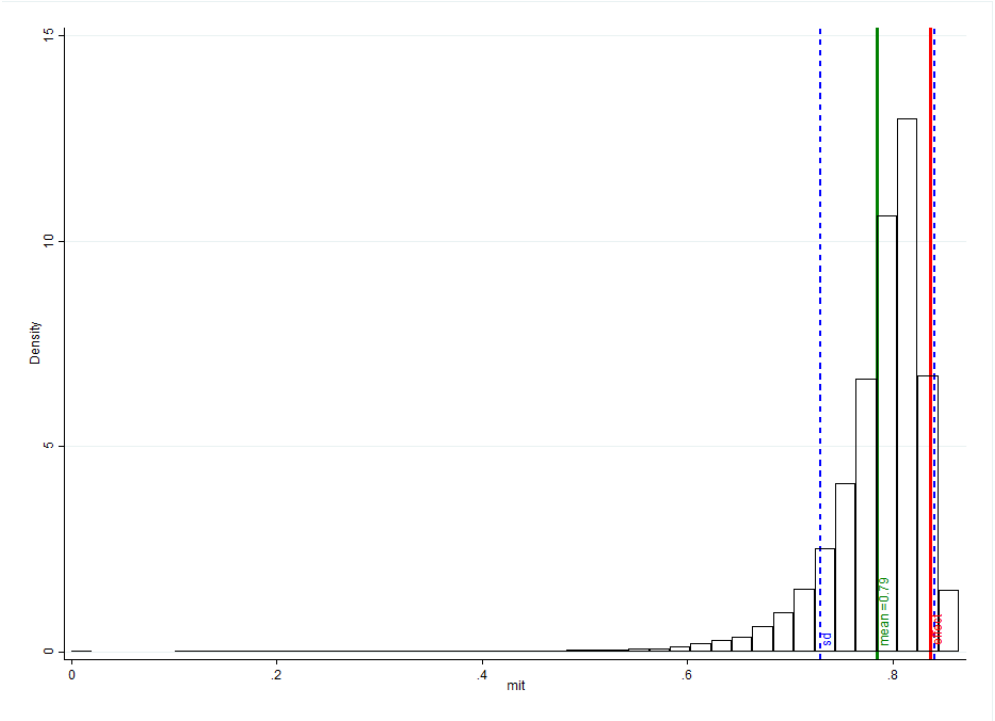
In column (2), which corresponds to the regression in which we control only for observed characteristics of buyers and time and industry fixed effects, the coefficient is equal to 0.052, with a standard error of 0.020. When we control also for contracts characteristics, adding the number of division in column (3) and the sector of the contract in column (4), results remain almost unchanged (coefficients respectively of 0.059 (standard error 0.020) and 0.061 (standard error 0.020)). Adding the values of the contract and of the division, which, as explained in section 3.4.2, are bad controls because they can be affected by the procedure, lowers the coefficient and its significance (column (5)). Finally, controlling for the expected number of bidders, which reduces the sample size, does not change the result (coefficient 0.066 and standard error 0.020).

Our main finding is in line with Baltrunaite et al. [2018], which finds that increasing public buyer's discretion leads to the selection of firms with lower productivity. It is also

consistent with the idea that open auctions is the most efficient mechanism to reveal the actual costs of participating firms (Manelli and Vincent [1995]; Burguet and Che [2004]), with productive firms bidding lower amounts and therefore winning tenders organized through open auctions. If we consider that more productive firms are able to complete the contracts at the lowest total cost for the buyer (including ex post adaptation costs) and providing the expected quality, then, on average, open auctions seem desirable. In a wider perspective for the economy, open auctions also direct public money towards productive firms, which helps promoting productivity, at the level of the economy.

To understand the magnitude of the result, we look at the distribution of the m_{it} within the Amadeus sample in the industry that represents most of the observations of our estimation sample, namely the construction industry. We focus on the year 2014 that has the largest number of observations in the Amadeus sample. The distribution of the m_{it} is graphed in Figure 3.4. It has a mean of 0.79 and a standard deviation of 0.056. The coefficient of interest estimated (0.052 in column (2) of Table 3.8) hence corresponds to a change in the m_{it} of almost one standard deviation. The implication is that the adapted procedure moves the relative productivity of the selected firm quite a lot down the distribution compared to open auction. Put differently, if we consider that the firm selected using an auction procedure is at the mean of the distribution of productivities, using an adapted procedure comparatively selects a firm that is in the first decile of the distribution of productivities.

Figure 3.4: Distribution of m_{it} in the Amadeus sample (construction industry in 2014)



Note: The green line represents the mean of the distribution. The blue lines represent one standard deviation from the mean. The red line represents the effect that we estimate.

Our regressions also show that as contracts get more divided (*Number of divisions*), less efficient firms are selected. The interpretation of this result could be that buyers are less performing into selecting suppliers when they must screen bids for more divisions. We also observe that time-invariant characteristics of the buyers such as its type or size do not impact the selection of a more productive firm, which is consistent with the idea that buyers perform differently depending on the tender at hand and not on their general characteristics.

Heterogeneity by sector

In Tables 3.9, 3.10 and 3.11, we look at whether the effects of the adapted procedure are heterogeneous across different sectors.

Table 3.9 distinguishes the effect between tenders related to public works (76% of the

estimation sample) and other types of tenders.

Table 3.9: Second-stage regressions - Heterogeneous effect for public works and other types of tenders

	(1) OLS	(2) IV-2SLS	(3) IV-2SLS	(4) IV-2SLS	(5) IV-2SLS
Adapted procedure	0.002	−0.061	0.001	−0.047*	−0.043
	(0.007)	(0.042)	(0.034)	(0.027)	(0.042)
Adapted procedure x Public Works	0.006	0.097***	0.050**	0.074***	0.103***
	(0.008)	(0.031)	(0.025)	(0.022)	(0.035)
Public Works	0.014**	−0.022*	−0.012	−0.012	−0.043***
	(0.007)	(0.011)	(0.010)	(0.010)	(0.015)
ln(Population)	−0.001	−0.002	−0.001	−0.002	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Type: county	−0.002	−0.003	0.000	−0.001	−0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: region	0.004	0.001	−0.002	0.002	−0.004
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
Type: agglomeration community	0.002	0.002	0.006	0.005	0.011**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: municipalities community	−0.003	−0.004	−0.003	−0.002	−0.005
	(0.005)	(0.006)	(0.005)	(0.005)	(0.013)
Type: urban community	−0.013**	−0.014**	−0.007	−0.007	−0.011
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)
ln(Experience)	−0.000	0.001	0.003	0.002	0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
ln(Number of divisions)			0.014***	0.012***	0.013***
			(0.002)	(0.002)	(0.003)
ln(Division_value)				−0.004***	−0.000
				(0.001)	(0.002)
ln(Total_value)				−0.003	0.000
				(0.002)	(0.003)
ln(Expected number of bidders)					0.001
					(0.002)
Constant	0.369***	0.397***	0.376***	0.450***	0.489***
	(0.036)	(0.036)	(0.035)	(0.039)	(0.042)
Obs	7396	7396	7396	7396	4278
F-stat	48	47	52	48	33

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the relative productivity of the firm which was selected m_{it} . All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city. Column (1) is estimated by OLS and columns (2) to (5) represent the IV-2SLS estimates. Standard errors are clustered at the firm level.

Columns (2), (3), (4) and (5) of Table 3.9 show that the effect of the adapted procedure differs between tenders related to public works and other types of tenders. The coefficient of *Adapted procedure* reflects the effect of using an adapted procedure in tenders not related to public works. The coefficient *Adapted procedure* × *Public Works* represents the additional effect in tenders concerning public works. We cannot reject the hypothesis that the coefficient of *Adapted procedure* is different from zero. On the contrary, the effect of the adapted procedure in tenders concerning public works is similar to the average effect (positive and statistically significant, coefficient 0.097 with standard error of 0.031 in column (2) and coefficient 0.050 with standard error of 0.025 in column (3)), which is not surprising since public works constitute 76% of the observations in the sample. Hence our main results seem to be mainly driven by public works[14].

[14]Interacting *Adapted Procedure* with the NACE Rev.2 classification of winning firms reveals also that the effect that we estimate comes mainly from companies active in the construction industry rather than in other sectors.

Table 3.10: Second-stage regressions - Heterogeneous effect by sector and value of tenders

	(1) OLS	(2) IV-2SLS	(3) IV-2SLS	(4) IV-2SLS	(5) IV-2SLS
Adapted procedure	0.002	−0.072*	−0.043	−0.050*	−0.037
	0.007	(0.041)	(0.036)	(0.028)	(0.041)
Adapted procedure x Small public Works (below threholds)	0.002	0.094***	0.073***	0.075***	0.098***
	(0.008)	(0.031)	(0.028)	(0.024)	(0.035)
Adapted procedure x Large public Works (above threholds)	0.008	0.104***	0.074***	0.077***	0.099***
	(0.008)	(0.031)	(0.028)	(0.023)	(0.035)
Small public Works (below threholds)	0.016**	−0.020*	−0.014	−0.013	−0.040**
	(0.007)	(0.012)	(0.011)	(0.011)	(0.016)
Public Works (above threholds)	0.013*	−0.022*	−0.022**	−0.010	−0.045***
	(0.007)	(0.012)	(0.010)	(0.010)	(0.016)
ln(Population)	−0.001	−0.002	−0.002	−0.002	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Type: county	−0.002	−0.004	−0.001	−0.001	−0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: region	0.004	0.002	0.001	0.002	−0.005
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
Type: agglomeration community	0.002	0.002	0.005	0.005	0.011**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: municipalities community	−0.003	−0.004	−0.003	−0.002	−0.005
	(0.005)	(0.006)	(0.005)	(0.005)	(0.013)
Type: urban community	−0.012**	−0.015**	−0.009	−0.007	−0.011
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)
ln(Experience)	−0.000	0.001	0.002	0.002	0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
ln(Number of divisions)			0.014***	0.012***	0.013***
			(0.002)	(0.002)	(0.003)
ln(Division_value)				−0.004***	−0.000
				(0.001)	(0.002)
ln(Total_value)				−0.004	0.002
				(0.002)	(0.003)
ln(Expected number of bidders)					0.001
					(0.002)
Obs	7396	7396	7396	7396	4278
F-stat	45	44	48	46	32

* p < 0.1, ** p < 0.05, *** p < 0.01. The dependent variable is the relative productivity of the firm which was selected m_{it} . All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city and the one for the sector is other sectors than public works. Column (1) is estimated by OLS and columns (2) to (5) represent the IV-2SLS estimates. Standard errors are clustered at the firm level.

In Table 3.10, we investigate whether the effect that we find for public works is driven by the values of contracts in public works exceeding the values of contracts in other sectors since the thresholds set by the European Commission above which formalized open auction procedures are compulsory are much higher in public works than in other sectors (see Table 3.1). We estimate the effect of using an adapted procedure distinguishing tenders concerning public works which are below the thresholds for other types of tenders (approximately below €200,000), above the thresholds for other types of tenders and tenders concerning other sectors than public works. The analysis is flawed by the fact that our measures of the values of the contracts are the final bids of winners and are hence potentially affected by the procedure chosen. It nevertheless gives an indication of whether the result is driven by high value contracts or not. All the IV-2SLS estimates of Table 3.10 show that the effect of *Adapted Procedure* is similar for tenders in public works which are above the thresholds set by the European Commission and below the thresholds set by the European Commission (coefficients of respectively 0.104 and 0.094 in column (2) and standard errors of 0.031 and 0.031 respectively). These results suggest that our main result is not driven only by high value contracts in public works but also by small value contracts in public works. The difference of effects between tenders in public works and other tenders hence does not come from differences in values but rather from differences between types of tenders.

In Table 3.11, we further investigate the heterogeneity of the effects among tenders which are not public works. We look at whether the effects of the adapted procedure are heterogeneous across different types of tenders, where types correspond to sectors, namely public works (76% of the estimation sample), expertise and studies (3%), supplies (11%) and services (10%). Public works correspond to construction, renovation and maintenance of public buildings. Expertise and studies correspond mainly to support for project management in construction and diverse studies. Supplies include any equipment, food or product. Services include printing of documents, public transport, cleaning services, insurance services, gardening services, etc.

Table 3.11: Second-stage regressions - Heterogeneous effect by sector of the contract

	(1) OLS	(2) IV-2SLS	(3) IV-2SLS	(4) IV-2SLS	(5) IV-2SLS
Adapted procedure	0.008***	0.030	0.049**	0.023	0.058***
	(0.003)	(0.021)	(0.020)	(0.016)	(0.019)
Adapted procedure x Expertise	−0.003	−0.073***	−0.046***	−0.053***	−0.035
	(0.007)	(0.024)	(0.016)	(0.020)	(0.036)
Adapted procedure x Services	−0.021	−0.141***	−0.072***	−0.108***	−0.142***
	(0.013)	(0.038)	(0.027)	(0.028)	(0.043)
Adapted procedure x Supplies	0.007	−0.077	−0.033	−0.056	−0.105
	(0.013)	(0.050)	(0.045)	(0.038)	(0.070)
ln(Population)	−0.001	−0.002	−0.001	−0.002	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Type: county	−0.002	−0.004	−0.000	−0.002	−0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: region	0.004	0.001	−0.002	0.002	−0.004
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
Type: agglomeration community	0.002	0.002	0.006	0.005	0.010*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: municipalities community	−0.004	−0.004	−0.003	−0.002	−0.003
	(0.005)	(0.006)	(0.005)	(0.005)	(0.013)
Type: urban community	−0.013**	−0.016**	−0.008	−0.008	−0.011
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)
ln(Experience)	−0.000	0.001	0.003	0.002	0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
ln(Number of divisions)			0.014***	0.012***	0.013***
			(0.002)	(0.002)	(0.003)
Sector: expertise	−0.004	0.022*	0.022**	0.014	0.018
	(0.008)	(0.013)	(0.010)	(0.012)	(0.024)
Sector: supplies	−0.023**	0.008	0.000	−0.001	0.041*
	(0.010)	(0.020)	(0.019)	(0.017)	(0.025)
Sector: services	−0.006	0.037***	0.023**	0.025**	0.049***
	(0.008)	(0.013)	(0.010)	(0.011)	(0.017)
ln(Division_value)				−0.004***	−0.000
				(0.001)	(0.002)
ln(Total_value)				−0.003	0.000
				(0.002)	(0.003)
ln(Expected number of bidders)					0.001
					(0.002)
Constant	0.384***	0.377***	0.366***	0.445***	0.449***
	(0.037)	(0.036)	(0.036)	(0.042)	(0.046)
Obs	7396	7396	7396	7396	4278
F-stat	45	40	46	42	29

* p < 0.1, ** p < 0.05, *** p < 0.01. The dependent variable is the relative productivity of the firm which was selected m_{it} . All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city and the one for the sector are public works. Column (1) is estimated by OLS and columns (2) to (5) represent the IV-2SLS estimates. Standard errors are clustered at the firm level.

Columns (2), (3), (4) and (5) of Table 3.11 show that the effect of the adapted procedure is heterogeneous across sectors. The baseline coefficient (*Adapted procedure*) represents the effect in public works. It is positive and statistically significant in columns (3) and (5) and positive and non significant in columns (2) and (4). Column (2) shows that the additional effect of the adapted procedure is negative and significant in expertise (coefficient of -0.073) and in services (coefficient of -0.141), meaning that, in these sectors, the adapted procedure selects relatively more productive firms than open auctions. The effect for supplies is not statistically significantly different from the one estimated for public works, but the points estimates are all negative, which suggests that the effect of the adapted procedure compared to an open auction is the same or smaller in supplies than in public works.

If we consider that more productive firms are able to complete the contracts at the lowest total cost for the buyer (including ex post adaptation costs) and providing the expected quality, the result for expertise and services is consistent with the idea that when goods and services are customized to the need of the buyer, which is the case in the sectors of studies and services, introducing discretion can lead to better overall outcomes. Additionally, since supplies are usually associated with low-complexity, the fact that open auction is a better selection mechanism is also consistent with the literature.

Public works are considered rather complex contracts which are subject to unexpected events and renegotiations. Yet, the effect is positive, meaning that the adapted procedure is a worst selection mechanism than open auction in terms of productivity of the selected supplier. We have shown further that this result is not driven only by small value contracts but also by high value contracts. Hence in contracts concerning public works, introducing discretion leads to the selection of less efficient firms, both in high and low value contracts.

3.6.3 Robustness checks

We test the robustness of our main results using different specifications. We modify the variable of interest by using labor productivity and measures of TFPs computed using the

approach proposed by Wooldridge [2009] instead of the approach of Levinsohn and Petrin [2003] (see Tables 3.12 and 3.13).

Table 3.12: Robustness - Labor productivity

	(1) OLS	(2) IV-2SLS	(3) IV-2SLS	(4) IV-2SLS	(5) IV-2SLS	(6) IV-2SLS
Adapted procedure	−0.000	0.060***	0.063***	0.069***	0.024*	0.024
	(0.002)	(0.019)	(0.020)	(0.021)	(0.014)	(0.019)
ln(Population)	−0.001	0.001	0.001	0.001	−0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Type: county	0.005*	0.010***	0.011***	0.011***	0.007**	0.010***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Type: region	0.002	−0.001	−0.002	−0.003	0.000	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Type: agglomeration community	0.003	0.006	0.007*	0.007*	0.005	0.009*
	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.005)
Type: municipalities community	0.002	0.004	0.005	0.005	0.003	−0.001
	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.009)
Type: urban community	0.005	0.008	0.010*	0.010*	0.007	0.007
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)
ln(Experience)	−0.002	−0.002	−0.001	−0.001	−0.001	−0.002
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
ln(Number of divisions)			0.006***	0.006***	0.005**	0.002
			(0.001)	(0.001)	(0.002)	(0.002)
Sector: expertise				0.014	0.009	0.015
				(0.009)	(0.007)	(0.010)
Sector: supplies				0.000	−0.003	0.001
				(0.007)	(0.006)	(0.007)
Sector: services				−0.000	−0.005	0.003
				(0.007)	(0.006)	(0.007)
ln(Division_value)					0.000	0.000
					(0.001)	(0.001)
ln(Total_value)					0.000	0.002
					(0.002)	(0.003)
ln(Expected number of bidders)						0.003
						(0.002)
Constant	0.862***	0.847***	0.842***	0.841***	0.845***	
	(0.023)	(0.023)	(0.023)	(0.024)	(0.032)	
Obs	3635	3601	3601	3601	3601	2085
F-stat	8.10	5.37	6.12	5.71	7.23	3.09
Weak identification test		60.65	58.35	61.41	84.83	31.94

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the relative productivity of the firm which was selected m_{it} . All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city and the one for the sector are public works. Column (1) is estimated by OLS and columns (2) to (6) represent the IV-2SLS estimates. The Stock-Yogo weak ID test critical values: 10% maximal IV size is 16.38. Standard errors are clustered at the firm level.

Table 3.13: Robustness - TFP estimated with Wooldridge's approach

	(1) OLS	(2) IV-2SLS	(3) IV-2SLS	(4) IV-2SLS	(5) IV-2SLS	(6) IV-2SLS
Adapted procedure	0.007***	0.046**	0.052***	0.054***	0.025*	0.061***
	(0.002)	(0.019)	(0.019)	(0.019)	(0.015)	(0.019)
ln(Population)	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Type: county	−0.002	−0.000	0.002	0.002	0.000	0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Type: region	0.004	−0.001	−0.003	−0.003	0.001	−0.007
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Type: agglomeration community	0.002	0.003	0.006	0.006	0.005	0.009*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Type: municipalities community	−0.004	−0.003	−0.002	−0.003	−0.002	−0.009
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.012)
Type: urban community	−0.011*	−0.008	−0.003	−0.004	−0.004	−0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
ln(Experience)	−0.000	0.001	0.002	0.003	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ln(Number of divisions)			0.014***	0.014***	0.012***	0.013***
			(0.002)	(0.002)	(0.002)	(0.002)
Sector: expertise				0.006	−0.001	0.013
				(0.006)	(0.006)	(0.010)
Sector: supplies				−0.011	−0.019*	0.010
				(0.009)	(0.010)	(0.017)
Sector: services				−0.000	−0.009	0.009
				(0.008)	(0.008)	(0.012)
ln(Division_value)					−0.003***	−0.000
					(0.001)	(0.001)
ln(Total_value)					−0.002	0.001
					(0.002)	(0.003)
ln(Expected number of bidders)						0.001
						(0.002)
Constant	0.406***	0.407***	0.393***	0.397***	0.460***	0.469***
	(0.034)	(0.034)	(0.034)	(0.035)	(0.040)	(0.044)
Obs	7441	7396	7396	7396	7396	4278
F-stat	49.52	51.28	53.64	49.76	48.37	31.79
Weak identification test		103.20	104.40	120.43	183.57	99.41

* p < 0.1, ** p < 0.05, *** p < 0.01. The dependent variable is the relative productivity of the firm which was selected m_{it} . All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city and the one for the sector are public works. Column (1) is estimated by OLS and columns (2) to (6) represent the IV-2SLS estimates. The Stock-Yogo weak ID test critical values: 10% maximal IV size is 16.38. Standard errors are clustered at the firm level.

In Table 3.12, firm's productivity is measured using labor productivity rather than TFP.

Results show that the effect of our main variable of interest *Adapted procedure* is of similar magnitude and significance level as the estimates from Table 3.8. In Table 3.13, TFP was calculated with the method which was developed by Wooldridge [2009]. Our results demonstrate a very strong robustness since our explanatory variable shows very strong similarities in terms of both sign, magnitude and significance.

3.7 Discussion

We have identified three channels which could explain our main result. First, it could be that firms self-select in some specific procedures. Second, it could be that buyers invite only some specific types of firms to bid in adapted procedures. Third, it could be that pools of bidders contain the most productive firms in both types of procedures but that the screening of firms leads to different outcomes.

Given the cost associated with keeping up with new tenders and the fact that the adapted procedure allows buyers to choose where to advertise, adapted procedures could attract fewer bidders. On the other side, one of the purposes of the adapted procedure is to attract SMEs and young firms as ex ante costs associated with submitting bids are lower in adapted procedures than in formalized procedures. Hence adapted procedures could attract more bidders and bidders with different characteristics than open auctions. Additionally, the adapted procedure allows for the ex ante selection of a pool of invited firms to participate to the tender, which would also result in the restriction of competition in adapted procedures.

To discriminate between these channels, we would ideally need the identities of all the bidders in the tenders to compare the pool of bidders in the two procedures. However this information is not available in our dataset. We hence look at the information that is available in our dataset, which is the number of bidders in tenders and the characteristics of the winners. We first assess the effect of the procedure over the number of participants in the tender. In a second step, we compare the characteristics of the winning firms.

3.7.1 Adapted procedure and number of bidders

In Table 3.14, we examine the effect of using an adapted procedure on the number of bidders. We start by estimating the equation using a Poisson regression, regressing the number of bidders on the procedures and controls for some observed characteristics of the buyers and the tender, as well as year-dummies. This specification is standard when the dependent variable is a count one (and the dependent variable is not over dispersed). Column (1) shows that the adapted procedure is not associated with the number of bidders. The effect is indeed small and not statistically significant (coefficient -0.038, standard error 0.028).

Table 3.14: Regression over the number of participants

	(1) Poisson	(2) IV-Poisson
Adapted procedure	−0.038	0.287
	(0.028)	(0.365)
ln(Population)	0.015	0.013
	(0.021)	(0.018)
Type: county	0.055	0.073
	(0.048)	(0.045)
Type: region	−0.051	−0.094
	(0.066)	(0.094)
Type: agglomeration community	0.014	0.028
	(0.046)	(0.053)
Type: municipalities community	−0.105*	−0.098
	(0.061)	(0.063)
Type: urban community	0.035	0.070
	(0.079)	(0.100)
ln(Experience)	−0.049*	−0.037
	(0.026)	(0.030)
Sector: expertise	0.269***	0.291***
	(0.053)	(0.060)
Sector: supplies	−0.137***	−0.096
	(0.038)	(0.062)
Sector: services	−0.131***	−0.070
	(0.040)	(0.086)
ln(Number of divisions)	0.058***	0.075***
	(0.019)	(0.029)
Constant	1.946***	1.854***
	(0.171)	(0.185)
Obs	7396	7396

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the number of bidders. All columns include year dummies. The omitted category of reference for the type of buyer is the city and the one for the sector are public works. Column (1) is estimated by Poisson and column (2) represent the IV-Poisson estimates. Standard errors are clustered at the buyer level.

In order to infer something on the causality between procedure and number of bidders, we focus on our Poisson-2SLS estimate. First, the competitive environment is likely to influence the choice of an awarding mechanism, yielding concerns for the presence of reverse causality. In particular, using open auctions generates more benefits when the degree of competition is high. Also, it is highly possible that our specification suffers from an omitted variable bias. Some unobserved factors explaining the adoption of an adapted

procedure could also be correlated with the number of bidders, in particular contract-specific characteristics. Therefore, we use a two-step procedure where we first regress the choice of the procedure over a set of explanatory variables. In a second step, we run an IV Poisson using the same instrument as in the main analysis. Column (2) shows that there is no significant effect of using an adapted procedure over the total number of participants to the tender.

We therefore conclude that our main result, namely that adapted procedures select less efficient firms, is not driven by a change in the size of the pool of bidders.

3.7.2 Adapted procedure and characteristics of winners

The dataset does not allow us to examine the characteristics of bidders between types of selection procedure because we do not have any information on all bidders. We are only able to look at the effect of procedures on supplier selection using observable characteristics of suppliers. The idea is to examine whether the differences in productivity observed in open auctions and adapted procedures come from observable characteristics of firms.

Table 3.15: Effect of the selection procedure on firm's characteristics

	(1) ln(turnover)	(2) ln(profit)	(3) Age (in years)	(4) ln(distance)
Adapted procedure	−0.437	−0.289	−2.906	−0.306
	(0.280)	(0.372)	(3.341)	(0.366)
ln(Population)	0.000	0.010	−0.006	−0.051**
	(0.030)	(0.029)	(0.315)	(0.023)
Type: county	−0.002	−0.003	−1.510**	0.226***
	(0.059)	(0.077)	(0.671)	(0.066)
Type: region	−0.106	−0.115	−0.462	0.622***
	(0.085)	(0.113)	(1.049)	(0.103)
Type: agglomeration community	−0.038	−0.054	0.322	0.061
	(0.052)	(0.076)	(0.747)	(0.075)
Type: municipalities community	0.051	0.102	0.057	0.132
	(0.078)	(0.100)	(1.047)	(0.087)
Type: urban community	0.281**	0.160	−0.467	0.009
	(0.121)	(0.127)	(1.726)	(0.134)
ln(Experience)	−0.015	0.027	0.183	0.071**
	(0.033)	(0.037)	(0.361)	(0.032)
ln(Number of divisions)	−0.292***	−0.257***	−0.353	−0.029
	(0.032)	(0.038)	(0.349)	(0.034)
Sector: expertise	−0.251**	−0.139	−4.241***	0.006
	(0.112)	(0.163)	(1.290)	(0.191)
Sector: supplies	0.241**	0.076	1.704	0.662***
	(0.104)	(0.138)	(1.354)	(0.119)
Sector: services	0.040	−0.056	−0.678	0.423***
	(0.103)	(0.137)	(1.184)	(0.109)
Constant	15.094***	11.183***	31.613***	3.977***
	(0.293)	(0.441)	(4.043)	(0.328)
Obs	7396	6696	7396	6461
F-stat	8.13	7.30	6.45	19.08
Weak identification test	94.63	102.60	94.63	84.03

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is ln(turnover) in column (1), ln(profit) in column(2), age in years in column (3) and ln(distance) in column (4). All columns include year dummies and industry dummies. The omitted category of reference for the type of buyer is the city and the one for the sector are public works. All columns represent the IV-2SLS estimates. The Stock-Yogo weak ID test critical values: 10% maximal IV size is 16.38. Standard errors are clustered at the firm level.

As for the examination of productivity, we are concerned that our specification suffers from an endogeneity problem. Therefore, the coefficients reported in this section are estimated using a two-step procedure with the prevalence of adapted procedures among other buyers as the instrument. Results from the IV regressions are displayed in Table 3.15. It shows that using an adapted procedure does not lead to the selection of a firm with a smaller

turnover (column (1)), less profits (column (2)), younger (column (3)) or closer to the buyer in distance (column (4)), since none of the coefficients are significant at the 10% minimum statistical level.

Since one of the main objectives of the implementation of adapted procedures is to foster the entry of SMEs and new firms in the public procurement market, we expect these types of firms to be more likely to win in this procedure. This is not the case in our dataset. A plausible explanation is that our dataset almost exclusively contains SMEs, since the 95th percentile of the distribution of turnovers in the sample is €37 million, SMEs being usually characterized as companies with turnovers below €50 million. Moreover, the minimum age of the firms observed in the sample is 3.5 years so that it does not contain new entrants, namely firms that are selected in a tender during their first year of activity.

The results displayed in Table 3.15 indicate that the difference in productivity observed among winning firms does not come from buyers targeting some firms with specific observable characteristics (small companies, new entrants or local companies) with the use of adapted procedures. Combined with the fact that the number of bidders is similar in both types of procedures, this suggests that buyers do not restrict the pool of bidders to some firms with specific observable characteristics in adapted procedures (in terms of age, size, profitability or localization at least).

Therefore, the effect that we observe may either come from pure discretion in the screening process or firms self-selecting into the type of procedure they participate in. Self-selection into procedures by firms would drive our result if the most productive firms did not bid in adapted procedures. However, there does not seem to be any reason why a productive firm that participates in open auctions would not do so in the case of adapted procedures since participating in open auctions is more costly than participating in adapted procedures. This suggests that our result is driven by the pure effect of discretion in the screening of firms, even if one would need to deepen the analysis by looking at the bidders in different types of procedures to draw a definite conclusion.

3.8 Conclusion

This chapter compares the productivity of suppliers selected in competitive tenders organized by public buyers using two different types of procedures. We evaluate whether an award procedure that increases discretion results in the selection of more or less productive firms. The question we address is hence that of the effect of discretion over the selection of suppliers.

Our main result, which is robust to several specifications and tests presented in the chapter, indicates that the adoption of an adapted procedure significantly increases the distance to the efficiency frontier, meaning that this awarding mechanism selects less efficient operators, resulting in an inefficient allocation of public funds towards less efficient firms. We provide some evidence in the last section of the chapter that it is driven by the pure effect of discretion in the screening of firms, even if one would need to deepen the analysis by looking at the bidders in different types of procedures to draw a definite conclusion.

We have identified two reasons to explain why public buyers select less efficient firms in adapted procedures. The first possible reason is that the public buyer chooses a procedure with increased discretion in order to be able to select a firm that he wishes to favor (for example if the public buyer is corrupted) so that the public buyer does not even try to select an efficient firm. The second possible reason comes from the purpose of the adapted procedure, which is to be adaptable to the circumstances of the purchase in order to save on ex ante transaction costs, including publication costs or screening costs. In this case, a public buyer would select a less efficient firm using the adapted procedure because he would spend less in the selection process. Put differently, the loss in productivity could be seen as the cost of reduced ex ante transaction costs.

If the selection of more productive firms is more likely to lead to lowered costs and/or better quality outcomes, discretion is potentially in contradiction with the primary objective of public procurement, which is to get the best outcome at the lowest price. However, one would have to balance the ex ante transaction costs, which we do not observe, with the

ex post outcomes of the procedures to conclude on whether increasing discretion in public tenders is, on average, beneficial. The implication of our result in terms of policy is that a procedure that would enable to avoid the trade-off between a loss in efficiency through the selection of less efficient firms and high ex ante transaction costs could improve the overall efficiency of public procurement. Such procedure would preserve a high degree of competition between firms and at the same time involve low ex ante costs and barriers to entry. The other implication of the result is that discretion is also in contradiction with one potential secondary objective of public procurement, which would be to promote productivity. We also show that the experience of the buyer, the complexity of the contract and the competitiveness of the environment are all positively associated with the use of open auctions.

Appendices

A1 Descriptive Statistics on the Amadeus sample

In the main analysis presented in the chapter, we use measures of TFP computed using an unbalanced sample of 1,252,194 firms covering the period 2005-2016. Table 16 presents the sectoral distribution of firms in this sample. Table 17 provides summary statistics on key variables used in the estimations of the production functions.

All variables entering the production functions were deflated using industry specific indices. We used indices provided in the EU KLEMS database. All these indices are specific to France and available at the two-digit NACE Rev 2 level. Value-added was deflated using the gross value-added price index, wages were deflated using an index of the compensation of employees, capital, defined as tangible assets, was deflated using the gross fixed capital formation index and materials, which correspond to intermediate consumption, were deflated using the intermediate inputs price index.

Table 16: Sector distribution of firms in Amadeus - Main estimation sample

Sector	Number of firms in 2014	Mean deflated value-added (k€)	Mean deflated wages (k€)	Mean deflated capital (k€)	Mean deflated materials (k€)
Agriculture, forestry and fishing	1,424	786	576	954	1,836
Mining industry	277	712	640	1,304	2,170
Manufacturing industry	22,835	2,487	1,863	1,103	5,863
Water production and distribution; sanitation, waste management and pollution	1,087	1,966	1,421	1,589	4,996
construction	20,327	1,112	969	210	2,640
Trade; repair of automobiles and motorcycles	53,809	996	703	325	5,465
Transport and storage	7,192	1,917	1,533	746	3,615
Accommodation and catering	7,570	862	613	648	1,023
Information and communication	3,462	2,869	1,995	438	3,488
Financial and insurance activities	2,707	5,589	3,836	2,942	13,479
Real estate activities	1,053	599	555	391	939
Specialized, scientific and technical activities	8,673	2,368	1,714	523	3,463
Activities of administrative and support services	5,413	2,298	1,740	449	2,571
Education	784	1,415	1,162	406	1,341
Human health and social action	3,670	2,318	1,733	722	1,815
Arts, entertainment and recreation	1,034	1,873	1,262	1,119	1,745
Other service activities	902	1,319	996	427	1,364

Table 17: Statistics on the Amadeus dataset - Main estimation sample

Variable	Number of observations	Mean	SD	Min	Max
Capital (kEuros)	1,252,194	573	2,005	1	36,534
Number of employees	549,819	40	76	1	2,823
Wages (kEuros)	1,252,194	1,241	2,472	8	29,294
Materials (kEuros)	1,252,194	4,515	10,591	88	145,349
Value-added (kEuros)	1,252,194	1,652	3,286	72	48,363

A2 Measures of total factor productivity

Total factor productivity (TFP) is computed estimating production functions relating output to inputs of firms. In the standard theory, the inputs considered are capital (which includes for example buildings) and factors of productions such as number of workers and materials. Output is either a measure of value-added or a measure of revenues of the firm. In this chapter, we estimate value-added production functions so that our measure of TFP reflects the contribution of each firm to the economy, holding factors inputs constant.

We estimate the Cobb-Douglas production function presented in equation 6 for each industry, industries being defined according to the broad structure of the NACE Rev.2 industry classification presented in Table 18.

Table 18: Broad structure of NACE Rev. 2

Section	Title
1	Agriculture, forestry and fishing
2	Mining and quarrying
3	Manufacturing
4	Electricity, gas, stream and air conditioning supply
5	Water supply; sewerage, waste management and remediation activities
6	Construction
7	Wholesale and retail trade; repair of motor vehicles and motorcycles
8	Transportation and storage
9	Accommodation and food service activities
10	Information and communication
11	Financial and insurance activities
12	Real estate activities
13	Professional, scientific and technical activities
14	Administrative and support service activities
15	Public Administration and defence; compulsory social security
16	Education
17	Human health and social work activities
18	Arts, entertainment and recreation
19	Other service activities
20	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use

$$Y_{it} = A_{it} L_{it}^{\beta_l} K_{it}^{\beta_k} \tag{6}$$

where Y_{it} is the value-added of firm i at time t, L_{it} is labor, K_{it} is capital and A_{it} is the Hicksian neutral efficiency level of firm i in period t. β_l and β_k are the parameters to estimate. The value-added and capital measures are measured in values. Labor is measured by wages.

Taking logs we obtain equation 7:

$$y_{it} = \alpha + \beta_l l_{it} + \beta_k k_{it} + w_{it} + \eta_{it} \tag{7}$$

where $y_{it} \equiv ln(Y_{it}), l_{it} \equiv ln(L_{it}), k_{it} \equiv ln(K_{it})$ and $ln(A_{it}) = \alpha + w_{it} + \eta_{it}$. α measures the mean efficiency level across firms, w_{it} is firm i's productivity in year t and η_{it} is the idiosyncratic error of firm i in year t. The key difference between w_{it} and η_{it} is that w_{it} affects firms' input demand so it refers to factors predictable by the firm (such as managerial ability) whereas η_{it} does not. η_{it} includes unexpected deviations from the mean due to measurement errors, unexpected delays or other unexpected situations.

There is a large and active empirical literature that estimates production functions. This literature shows that the use of OLS is inappropriate. The main problem with OLS is that of simultaneity. OLS treats labor, capital and material as exogenous variables, meaning that they are determined independently of productivity. However if firms observe some productivity shocks which are not observed by the econometrician and that this affects decisions concerning input levels (hiring), estimated coefficients are biased. The literature shows that firm-level fixed effects do not solve the problem because time-varying productivity shocks can affect a firm's input decisions. Several procedures have been proposed in the literature to overcome this problem (see for instance Olley and Pakes [1996], Blundell and Bond [2000] or Levinsohn and Petrin [2003]). To solve the simultaneity problem, we resort to the procedure suggested by Levinsohn and Petrin [2003], which estimates the production function in two steps and uses intermediate inputs (materials and energy) as a proxy for unobserved productivity. This procedure extends the procedure of Olley and Pakes [1996] which relies on investment to proxy for unobserved productivity

shocks. To test the robustness of our results, we also use the more recent approach proposed by Wooldridge [2009] which combines the two steps used in the Olley and Pakes [1996] or Levinsohn and Petrin [2003] methods into one single step using GMM thereby allowing to overcome some potential identification issues related to the approaches of Olley and Pakes [1996] and Levinsohn and Petrin [2003].

Another difficulty in the estimation of production functions comes from entry and exit of firms, which potentially creates a selection bias. The bias comes from the fact that firms decide the allocation of inputs in a given period conditional on their survival and that firm with a higher capital stock will be able to survive with a lower productivity level, creating a bias in the capital coefficient. Olley and Pakes [1996] proposed a method to take into account this bias. However in the Amadeus dataset, firms are automatically removed if they do not report information during the last five years. We are not able to distinguish exit from the sample from exit from the economy. We are hence not able to account explicitly for exit in the analysis. However very small changes in the production function coefficients are generally found after implementing the correction for the selection bias (see de Loecker [2011] and Van Beveren [2012]).

The estimation of production functions also faces a difficulty referred to as the omitted price problem. Most datasets, including Amadeus, report neither value-added nor capital in value or firm-level prices, hence deflated value-added and capital are used as measures of output and input. The use of deflated value-added means that unobserved differences in prices that deviate from the industry average price are buried in the residual term. In practice, there is a high correlation between these two measures as shown by Foster et al. [2008] which has data on plant level input and output prices. It is hence unclear whether using measures in volume would make too much of a practical difference to our results.

We consider alternative ways to estimate TFP : we use the approaches by Levinsohn and Petrin [2003] and Wooldridge [2009]. We estimate TFP by industry (defined at the broad NACE Rev.2 level). Results of the coefficients on labor and capital obtained for each industry using the 10-year unbalanced panel, to which we apply the Levinsohn Petrin

approach, are reported respectively in Figures 5 and 6. Depending on the industry, coefficients on labor obtained range between 0.70 and 0.85 while coefficients on capital fall between 0.01 and 0.08.

Figure 5: Coefficients on ln(labour)

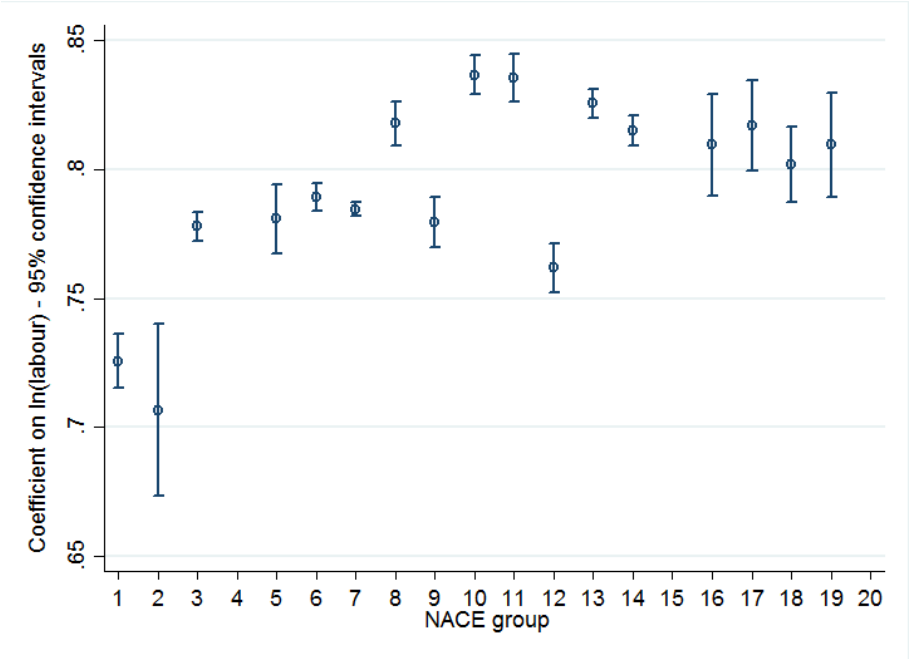
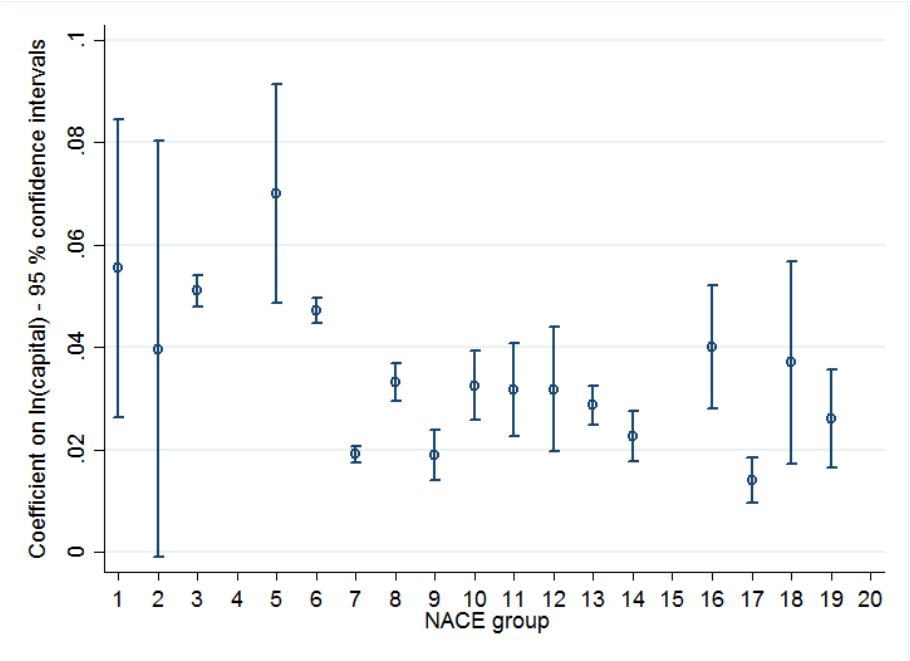


Figure 6: Coefficients on ln(capital)



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Essays on Decision Theory and Economic Efficiency

Abstract. This doctoral thesis focuses on two distinct themes: decision-making in situations of risk and economic efficiency. These two questions are treated in an empirical framework using unique databases. The first chapter tests the theoretical models of decision under risk on bets on horseraces to identify the theory that allows the best description of individuals' choices. This chapter shows that behavioral theories of decision under risk (cumulative prospect theory and rank-dependent utility) are better suited to explain the behavior of bettors observed in the data than the expected utility theory. The second chapter estimates the effect of a merger between two large companies in the urban transport sector in France on their costs. The results show that the merger did not result in efficiency gains for the merging parties. This result can be understood in light of the context in which the merger was conducted, in particular the reasons for the choice of the target, the perception of customers and employees of the merger, the differences in culture between the companies and the operational preparation of the merger. The third chapter examines the impact of greater discretion in tendering procedures on the selection of operators, particularly their productivity. The main result is that the procedure that potentially increases the discretion of public purchasers leads to the selection of less efficient companies than a procedure involving little or no discretion. Further analyzes suggest that the result is due to the effect of greater discretion at the screening stage.
Keywords: Decision-making, Merger ex post evaluation, Cost efficiencies, Award procedure, Productivity, Public procurement.

Essais sur la théorie de la décision et l'efficacité économique

Résumé. Cette thèse de doctorat s'intéresse à deux thèmes distincts : la prise de décision en situation de risque et l'efficacité économique. Ces deux questions sont traitées dans un cadre empirique en utilisant des bases de données uniques. Le premier chapitre teste les modèles théoriques de décision en situation de risque sur des données réelles de paris hippiques pour identifier la théorie qui permet la meilleure description des choix des individus. Ce chapitre montre que les théories comportementales de la décision en situation de risque (théorie des perspectives cumulées et modèle de l'utilité dépendante du rang) sont mieux adaptées pour expliquer le comportement des parieurs observé dans les données que la théorie de l'utilité espérée. Le second chapitre estime l'effet d'une concentration entre deux grandes entreprises du secteur des transports urbains en France sur leurs coûts. Les résultats obtenus mettent en évidence que la fusion n'a pas entraîné de gains d'efficacité pour les parties à la fusion. Ce résultat s'explique notamment par le contexte dans lequel la fusion a été menée, en particulier les raisons du choix de la cible, la perception des clients et des employés de la fusion, les différences de culture entre les entreprises et la préparation opérationnelle de l'opération. Le troisième chapitre examine l'impact d'une plus grande discrétion dans les procédures d'appels d'offres sur la sélection des opérateurs, en particulier leur productivité. Le résultat principal est que la procédure qui accroit potentiellement le pouvoir discrétionnaire des acheteurs publics conduit à la sélection d'entreprises moins efficaces qu'une procédure n'impliquant pas ou peu de discrétion. Nos analyses complémentaires suggèrent que le résultat s'explique par l'effet d'une plus grande discrétion à l'étape de sélection des entreprises.
Mots-clés : Prise de décision, Évaluation ex post des fusions, Gains d'efficacité, Procédure d'attribution, Productivité, Marchés publics.