Genre et goût pour la compétition : une approche par l'économie expérimentale

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Contents

Résumé

Pourquoi une étude expérimentale sur le genre?

Sur tous les marchés du travail occidentaux, on observe que les femmes perçoivent des salaires moins importants que les hommes et occupent des postes moins prestigieux. L'une des études la plus fréquemment citée documentant ce fait stylisé est celle de Bertrand & Hallock (2001) selon laquelle les femmes ne représentent que 2.5% des cadres dirigeants d'un large échantillon d'entreprises américaines. En 1998, le revenu hebdomadaire médian des femmes travaillant à plein temps atteignait seulement 76% de celui des hommes (Bowler, 1999). Des différences hommes-femmes prévalent également en politique. Fox & Lawless (2004) ont ainsi trouvé qu'à caractéristiques personnelles et professionnelles égales, les femmes expriment nettement moins que les hommes l'ambition d'obtenir un mandat électif.

Alors que deux explications pourraient être une moindre compétence des femmes à diriger ou une discrimination à leur encontre, une explication alternative à laquelle une littérature récente s'intéresse concerne les différences hommes-femmes de préférences (Croson & Gneezy, 2009). En effet, si les femmes ont un moindre goût pour le risque (voir Eckel & Grossman (2008b) pour une revue de littératue [1]) ou la compétition que les hommes ou si

1. Certaines études n'ont pas trouvé de différences hommes-femmes d'attitude face au risque, mais les autres tendent à montrer que les femmes sont plus averses au risque que les hommes.

elles valorisent davantage l'équité et ont, en général, des préférences sociales plus affirmées (Andreoni & Vesterlund, 2001), elles se porteront moins souvent candidates aux postes caractérisés par un niveau élevé de risque et de compétition. Comme ces postes sont justement ceux correspondant à des salaires élevés et des responsabilités importantes, cela expliquerait la sous-représentation des femmes dans des emplois socialement valorisés. Dans cette thèse, les différences hommes-femmes de confiance en soi et de propensité à s'engager dans des environnements compétitifs sont étudiées ainsi que le rôle qu'elles jouent pour expliquer la sous-représentation des femmes au sommet des hiérarchies.

Bien qu'il soit probablement illusoire d'espérer complètement démêler les nombreux facteurs qui pourraient causer une réaction différente des hommes et des femmes à la compétition, il est sans aucun doute possible de mieux comprendre les raisons sous-jacentes à la décision de s'engager ou non dans une compétition. Cela pourrait, en outre, permettre de trouver des solutions pour obtenir que davantage de femmes se portent candidates à des postes élevés. Alors que la parité peut être considérée par certains comme un objectif en lui-même, elle peut aussi être nécessaire pour attirer les meilleurs candidats possibles, indépendamment de leur genre.

Dans cette introduction, après avoir exposé les avantages et inconvénients de l'économie expérimentale en tant qu'outil pour étudier les différences hommes-femmes de préférence pour la compétition, une revue de littérature sur ce même sujet est présentée. Une section est ensuite consacrée aux résultats qui éclairent le débat sur les rôles respectifs de l'inné et de l'acquis dans les différences de genre observées. La section suivante s'intéresse aux expériences proposant des solutions pour amener les hommes et les femmes à entrer en compétition et se fixer des défis dans des proportions plus similaires. Un plan de la thèse

est finalement proposé et des résumés de chacun des trois chapitres sont donnés.

0.1. Avantages et inconvénients de l'économie expérimentale

L'économie expérimentale permet de contrôler beaucoup de facteurs qui jouent un rôle dans le monde réel et d'isoler ainsi une explication particulière pour un comportement observé. Cela est spécialement utile pour le sujet qui nous intéresse car de nombreux facteurs peuvent expliquer pourquoi les femmes ont des revenus inférieurs à ceux des hommes et occupent des postes moins prestigieux et il est impossible de mesurer leur importance respective en observant les données disponibles sur le marché du travail. En effet, si l'on remarque que les cadres dirigeants sont plus souvent des hommes que des femmes, cela pourrait être dû au fait que les femmes sont moins qualifiées que les hommes pour occuper de tels postes ou que les femmes sont victimes de discrimination. Cela pourrait également être lié au fait que les femmes ne souhaitent pas postuler à des emplois impliquant de trop longues heures de travail car elles valorisent le temps passé en famille davantage que les hommes ou au fait qu'elles sous-estiment leurs chances d'obtenir le poste face à un homme. Cependant, l'étude du marché du travail ne permettra que d'obtenir des informations sur les rares femmes qui ont candidaté et obtenu un poste de cadre dirigeant mais il sera impossible de connaître les raisons de l'absence des femmes que l'on n'observe pas. Les expériences en laboratoire requièrent des sujets qu'ils participent à une expérience d'une heure pendant laquelle il leur est demandé de prendre des décisions dans un contexte très précis. Cela permet d'éliminer plusieurs explications potentielles pour un comportement observé donné. Par exemple, si on trouve que les femmes font des choix moins ambitieux que les hommes dans le laboratoire, cela ne peut être mis sur le compte

d'un désir plus prononcé de passer du temps avec leurs enfants, ni à leur crainte d'être victime de discrimination.

Comme les expériences en laboratoire nécessitent manifestement de simplifier le contexte dans lequel les décisions sont prises, il est parfois objecté qu'il est difficile de connecter des décisions prises dans des conditions si artificielles avec ce qui se passerait dans le monde réel. Il convient par conséquent de prendre les précautions nécessaires dans la création du protocole expérimental afin de pouvoir extrapoler dans le monde réel les résultats expérimentaux obtenus.

0.2. Différences hommes-femmes de confiance en soi, goût pour la compétition et besoin de relevé des défis: une revue de littérature des résultats expérimentaux existants

Une littérature récente s'intéresse aux différences hommes-femmes de confiance en soi et de volonté d'entrer dans des environnements compétitifs. La plupart des études portant sur le genre et la confiance en soi trouvent que les hommes sont plus confiants que les femmes ou, plus exactement, plus surconfiants, puisque les femmes comme les hommes sont sujettes au biais de surconfiance. Non seulement les hommes sont davantage surconfiants, mais ils sont également nettement plus enclins que les femmes à entrer dans des environnements compétitifs et les différences hommes-femmes de performance, de confiance en soi et d'attitude face au risque ne suffisent pas à expliquer leur surcroît d'attirance pour la compétition par rapport aux femmes. Les résultats existants suggèrent cependant égale-

ment que les femmes ne rejettent pas toutes les formes de compétition et sont sensibles aux incitations.

Un nombre incalculable d'études soutiennent que la majorité des individus manifestent de la surconfiance et fournissent des preuves qui confirment cette affirmation (La plus célèbre de ces études est celle de Svenson (1981)). Benoit & Dubra (2009) a montré que beaucoup des exemples cités par la littérature ne constituent pas réellement des preuves de surconfiance. En effet, la mise à jour des croyances consécutive à la réception d'un signal sur leur performance peut conduite une majorité d'individus à se penser meilleurs que l'individu médian. Certains résultats empiriques ou expérimentaux s'apparentent néanmoins bel et bien à de la surconfiance et la trop fréquente attribution de certains comportements à de la surconfiance ne peut expliquer les différences entre hommes et femmes qui sont souvent rapportées.

Les niveaux de surconfiance constatés sont plus élevés dans les domaines dans lesquels les sujets se sentent compétents (Heath & Tversky, 1991). D'après de nombreuses recherches, les hommes sont plus surconfiants que les femmes (même si les femmes font, le plus souvent également, preuve de surconfiance). Prince (1993) montre que les hommes ont tendance à se sentir plus compétents que les femmes dans le domaine de la finance. Niederle & Vesterlund (2007) trouvent que respectivement 43% et 75% des femmes et des hommes ayant participé à leur expérience pensent avoir une performance les plaçant parmi les 25% meilleurs participants suggérant que les femmes souffrent comme les hommes de surconfiance mais dans une moindre proportion. Ces différences hommes-femmes de confiance en soi se traduisent dans les actes et produisent de ce fait des écarts en terme de revenus. Barber & Odean (2001) trouvent ainsi, par exemple, qu'en raison d'une surconfiance plus

élevée, les hommes sont plus actifs sur les marchés financiers.

Un pan entier de la littérature traite de la confiance que les individus placent dans leurs connaissances, appelée calibration, et des éléments contradictoires existent concernant une plus grande surconfiance des hommes dans ce domaine. Alors que Lichtenstein & Fischhoff (1981) n'avaient trouvé aucune différence de calibration entre les hommes et les femmes, les résultats de Lundeberg *et al.* (1994) montrent que les hommes ont davantage tendance que les femmes à déclarer des niveaux élevés de confiance dans leur savoir lorsqu'ils ont tort. Lundeberg *et al.* (1994) affirment, en outre, que les différences hommes-femmes de calibration dépendent du type de question et sont plus fortes pour celles considérées comme appartenant au domaine masculin. Pallier (2003) suggère également que les hommes ont davantage confiance dans leur savoir que les femmes. Néanmoins, soumis à un mécanisme incitatif, les sujets de Blavatskyy (2009) font en moyenne preuve de sous-confiance dans leurs connaissances. Dans une tâche où les sujets ont à fournir des intervalles de confiance pour une série de questions, Cesarini *et al.* (2006) trouve même un degré de sur-confiance supérieur chez les femmes.

Ces dernières années, une littérature concernant les différences hommes-femmes de goût pour la compétition s'est largement développée. Elle permet de s'interroger sur une explication possible pour la sous-représentation des femmes parmi les travailleurs occupant des postes à responsabilités et salaires élevés.

Bengtsson *et al.* (2005) exploitent les réponses à un examen pour lequel une dernière question peut permettre à un étudiant d'augmenter sa note à la seule condition qu'il ait obtenu une très bonne note aux questions précédentes. Les hommes choisissent plus souvent de répondre à la dernière question à la fois dans le sous-groupe des étudiants ayant

très bien répondus aux premières questions et dans le sous-groupe n'y ayant pas très bien répondu dont les membres ne peuvent, par conséquent, pas augmenter leur note en répondant correctement à la dernière question. La différence hommes-femmes de propension à répondre à la dernière question est toutefois plus grande dans le second groupe. Cela tend à montrer que les femmes très performantes n'ont pas assez tenté de répondre à la dernière question par rapport aux hommes tandis que, dans une plus grande mesure, les hommes peu performants ont eu inefficacement trop tendance à donner une réponse à la dernière question.

L'expérience de Page *et al.* (2007) réplique certaines caractéristiques des choix d'éducation. Les participants doivent résoudre un certain nombre d'anagrammes afin de passer à l'étape suivante. En outre, les participants ont, à deux reprises pendant l'expérience, à choisir s'ils souhaitent arrêter l'expérience et obtenir leur paiement actuel ou continuer au niveau suivant (composé de plusieurs étapes) plus difficile que le précédent. Le choix de passer au niveau suivant s'accompagne du risque de repartir avec un paiement inférieur au montant actuel si le participant ne parvient pas à résoudre le nombre d'anagrammes requis à ce niveau. Afin de modéliser différents niveaux d'aspiration, deux traitements sont mis en place: un traitement gain (niveau d'aspiration bas) et un traitement perte (niveau d'aspiration élevé). Dans le traitement gain, les participants débutent l'expérience avec un montant nul et peuvent augmenter leurs gains en résolvant des anagrammes et en choisissant de continuer ou non au niveau supérieur. Le point de référence des participants correspond ainsi au montant nul, symbolisant un niveau d'aspiration bas, puisque les participants ne peuvent qu'augmenter leurs gains au cours de l'expérience. Dans le traitement perte, les participants reçoivent en début d'expérience une somme correspondant au mon-

tant maximal qu'il est possible de gagner. Les participants perdent par la suite une partie de leur dotation initiale s'ils n'arrivent pas à résoudre assez d'anagrammes ou s'ils choisissent de s'arrêter avant la fin de l'expérience. Le point de référence représentant le niveau d'aspiration est donc élevé puisque les participants ne peuvent que perdre une partie de la somme perçue au départ. Dans chacun des deux traitements, les hommes ont été plus ambitieux que les femmes, choisissant plus souvent de continuer au niveau suivant. En outre, seuls les hommes voient leur performance augmenter dans le traitement perte ce qui suggère que le surcroit d'utilité marginale que permet d'obtenir une meilleure performance en raison de l'aversion à la perte a un effet sur les hommes mais pas sur les femmes. Ce résultat est à rapprocher de ceux de Gneezy *et al.* (2003), Gneezy & Rustichini (2004), Ors *et al.* (2008) qui trouvent que les hommes soumis à la pression de la compétition augmentent leur performance alors que ce n'est pas le cas des femmes.

Niederle & Yestrumskas (2007) observent, que lorsqu'ils ont le choix entre une tâche facile et une tâche difficile, à performance égale, les hommes choisissent 50% plus souvent que les femmes la tâche difficile.

Niederle & Vesterlund (2007) et Gupta *et al.* (2005) trouvent que les femmes choisissent significativement moins souvent d'entrer dans un tournoi lorsqu'ils ont le choix entre un mode de rémunération en tournoi et une rémunération à la pièce. Les différences hommes-femmes de confiance en soi et d'attitude face au risque expliquent en partie pourquoi les hommes choisissent davantage le tournoi que les femmes mais une explication résiduelle provient d'un goût intrinsèque pour la compétition plus important pour les hommes que pour les femmes. Leurs résultats montrent également qu'en comparaison avec les choix qui auraient maximisé leurs gains, les hommes peu performants choisissent trop souvent

d'entrer en compétition tandis que les femmes très performantes n'entrent pas suffisamment.

Connaître les origines des différences hommes-femmes de préférence pourrait permettre de limiter leurs conséquences néfastes. La section qui suit étudie l'importance relative de l'inné et de l'acquis dans la formation de préférences différentes pour les hommes et les femmes.

0.3. Les origines des préférences: inné ou acquis?

Savoir si les hommes et les femmes sont intrinsèquement différents en ce qui concerne la confiance en soi, l'attitude face au risque ou le goût pour la compétition ou si l'éducation et la culture ont un rôle à jouer dans la fondation de ces comportements est d'une importance cruciale. Cela détermine en effet en grande partie la mesure dans laquelle des changements institutionnels peuvent parvenir à changer les comportements compétitifs en amenant les femmes performantes à entrer davantage en compétition tout en décourageant les hommes peu performants de le faire. Les études présentées ici tentent de démêler les rôles respectifs de l'inné (taux d'hormones) et de l'acquis (rôles dévolus aux hommes et aux femmes dans la société, écoles mixtes ou uni-sexes) comme déterminants du comportement face à la compétition. Comme on pouvait s'y attendre, la littérature existante suggère que l'inné et l'acquis sont tous deux des éléments importants pour déterminer l'attitude face à la compétition d'un individu.

Gneezy *et al.* (2008) traitent cette question en comparant les choix d'entrer ou non en compétition d'hommes et de femmes appartenant à une société matriarcale (les Khasi en Inde) et à une société patriarcale (les Maasai en Tanzanie). Alors que les hommes Maasai

choisissent la compétition presque deux fois plus souvent que les femmes Maasai, dans la société Khasi, les femmes sont davantage attirées par la compétition que les hommes. Ces résultats ne permettent toutefois pas de tirer la conclusion définitive que l'acquis détermine les différences hommes-femmes de comportement compétitif puisque la génétique pourrait expliquer à la fois les différences hommes-femmes de propension à entrer dans des environnements compétitifs et la raison pour laquelle une société est matriarcale ou patriarcale.

Booth & Nolen (2009) comparent le choix d'entrer en compétition d'enfants d'écoles publiques mixtes et uni-sexes afin d'établir l'importance de l'acquis dans ce type de choix. Il est en effet improbable que de grandes différences génétiques existent selon le type d'école que fréquente un enfant. Leur résultat principal est que les filles fréquentant une école uni-sexe sont plus enclines à faire le choix de la compétition que celles qui vont dans une école mixte. C'est également le cas dans le contexte de la compétition mixte. Ces résultats vont dans le sens de la théorie de l'identité sexuelle selon laquelle les hommes et les femmes agissent de sorte à se conformer au stéréotype imposé la société sur le comportement attendu d'un homme ou d'une femme. En effet, les femmes peuvent ressentir une pression moindre à se conformer au stéréotype du comportement féminin quand elles ne sont pas confrontées à des regards masculins. Ces résultats tendent à prouver l'importance de la culture dans le conditionnement des attitudes vis-à-vis de la compétition.

Une autre étude apporte un éclairage sur le poids de la culture dans la détermination des différences hommes-femmes de performance en mathématiques dont on pense souvent qu'elles sont innées. D'après Guiso *et al.* (2008), il existe une corrélation entre les différences hommes-femmes de succès en mathématiques et la manière dont sont perçues les

femmes par rapport aux hommes dans la société telle que mesurée par le *Gender Gap Index* du Forum economique mondial et les réponses aux *World Value Surveys*. De surcroît, les différences de performance en mathématiques entre hommes et femmes tendent à disparaître dans les pays où les femmes sont davantage traitées comme égales aux hommes.

Toutes les données empiriques ne vont cependant pas dans le sens de l'hypothèse favorisant l'acquis. L'expérience de Buser (2009) prouve clairement l'importance de l'inné en montrant que les niveaux d'hormones sexuelles féminines sont corrélées à la propension des femmes à entrer en compétition. Sapienza *et al.* (2009) trouvent dans la même veine que les individus dont le taux de testostérone est élevé ont davantage tendance à choisir une carrière risquée dans le domaine de la finance. En outre, une littérature récente étudie le lien entre le ratio de la longueur de l'index sur celle de l'annulaire, correspondant à une mesure brute de l'exposition in-utero à la testostérone, et le degré d'assurance des femmes (Wilson, 1983), le talent pour jouer au football ds hommes (Manning & Taylor, 2001), les performances sportives des femmes (Paul *et al.*, 2006) et de nombreuses autres caractéristiques. Coates *et al.* (2009) montrent que ce ratio prédit les profits à long terme de traders ainsi que la durée de leur carrière. Aucune étude ne s'intéresse encore, à ma connaissance, au lien entre ce ratio et la propension à entrer dans des environnements compétitifs mais cela pourrait fournir des preuves supplémentaires de l'importance du rôle de l'inné dans la détermination du goût pour la compétition.

En utilisant des données sur des jumeaux dizygotes et monozygotes, Barnea *et al.* (2009) montrent que les choix d'investissement des jumeaux sont significativement corrélés y compris dans le cas de jumeaux élevés séparément. Les auteurs concluent que jusqu'à 45% de l'hétérogénéité dans les choix d'investissement peut être expliquée par des facteurs

génétiques.

Il semble ainsi que ni l'inné ni l'acquis ne puisse expliquer seul les différences hommes-femmes de réaction à la compétition. En conséquence, des changements institutionnels peuvent sans doute avoir un impact sur les décisions d'entrer en compétition et de faire des choix ambitieux. Cela pourrait non seulement promouvoir la parité mais également permettre que les individus les plus qualifiés, quel que soit leur sexe, se portent candidat et, par conséquent, occupent les postes les plus élevés.

0.4. Implications en terme de politique économique

Il est légitime de se demander si l'on doit tenter de réduire les différences hommes-femmes de volonté d'enter en compétition et amener les femmes à se porter plus souvent candidates à des emplois de haut niveau. En effet, si les femmes ne souhaitent pas postuler à de tels emplois, aller contre leur volonté peut ne pas être socialement désirable. Il existe cependant deux raisons pour lesquelles la société pourrait profiter d'un rééquilibrage du goût pour la compétition des hommes et des femmes. Premièrement, une meilleure représentation des femmes aux postes clés des entreprises pourrait être souhaitable en soi. Des études ont en effet montré que la présence de femmes dans le conseil d'administration d'une entreprise est bénéfique pour elle et que cela les aidait à traverser la crise financière (Erkut, 2006, Ferrary, 2008). Deuxièmement, il serait efficace d'encourager les femmes performantes à candidater aux compétitions qui mènent aux postes les plus valorisés tout en dissuadant les hommes peu perfomants de le faire. Cela permettrait, en effet, d'amener des personnes plus compétentes à postuler et occuper les postes clés des entreprises. Ces deux éléments entrent sans doute dans la fonction d'utilité du planificateur social et guident

la réflection sur les mesures nécessaires à une amélioration de l'efficacité et du bien-être social.

Les résultats expérimentaux existants indiquent que le comportement des hommes comme des femmes face à la compétition peut être modifié au moyen de la mise en place d'incitations et de changements institutionnels.

Gupta *et al.* (2005) trouvent que les hommes comme les femmes réagissent à l'augmentation de l'espérance de gain d'un tournoi par rapport à celle d'une rémunération à la pièce. Les différences hommes-femmes de décision d'entrer en tournoi demeurent cependant fortes et significatives.

Niederle & Yestrumskas (2007) s'interrogent sur la manière dont un changement institutionnel peut rendre les hommes et les femmes plus semblables quant à l'ambition de leurs choix. Après avoir réalisé une tâche une première fois et confrontées à un choix entre une tâche facile et une tâche difficile, mieux rémunérée, pour les deux périodes suivantes, les femmes font le choix de la tâche facile plus souvent que les hommes. Lorsque les participants peuvent, dans un premier temps, faire leur choix uniquement pour la période suivante avec la possibilité de changer d'avis pour la troisième période, les femmes performantes rejoignent les hommes performants en faisant le choix de la tâche difficile. Il apparaît ainsi que les femmes performantes ne sont pas intrinsèquement hostiles à entreprendre la tâche difficile, mais qu'elles sont plutôt davantage incertaines quant à leur capacité à réussir une bonne performance.

Une autre manière d'inciter davantage de femmes à tenter leur chance dans des compétitions est d'augmenter leur probabilité de gagner par rapport aux hommes. Niederle *et al.* (2008) étudient l'effet de mesures de discrimination positive sur la décision d'hommes

et de femmes d'entrer en compétition. Lorsqu'il est établi qu'au moins un gagnant d'un tournoi sur deux sera une femme, davantage de femmes et moins d'hommes choisissent d'entrer en compétition et cet effet dépasse ce qui serait prédit par le seul changement des probabilités de gagner. Le fait que la discrimination positive rende la compétition plus uni-sexe (Il suffit à une femme de battre toutes les autres femmes pour faire partie des gagnants tandis qu'un homme doit non seulement battre tous les autres hommes mais aussi obtenir au minimum la seconde meilleure performance parmi l'ensemble des participants.) mais aussi le simple fait de mentionner la discrimination positive contribuent à expliquer ce résultat.

Les résultats expérimentaux présentés ci-dessus prouvent bien que les femmes ne rejettent pas la compétition en bloc et qu'il existe des moyens de les inciter à tenter davantage leur chance dans les environnements compétitifs.

0.5. Plan de thèse

Cette thèse traite de l'impact de la mise en place d'incitations et de changements institutionnels sur des comportements qui sont typiquement différents pour les hommes et les femmes.

Le premier chapitre constitue une tentative pour réduire la surconfiance que les individus ont en leurs connaissances, un biais cognitif très répandu ayant des conséquences économiques. Les deux chapitres suivants s'intéressent aux différences hommes-femmes de propension à entrer dans des environnements compétitifs qui font récemment l'objet d'un intérêt croissant des économistes (Gneezy *et al.* (2003), Gneezy & Rustichini (2004), Gupta *et al.* (2005), Niederle & Vesterlund (2007), Niederle & Yestrumskas (2007), Niederle

et al. (2008), Booth & Nolen (2009)...). Ici, l'impact du fait qu'une compétition oppose des équipes plutôt que des individus sur la volonté des hommes et des femmes d'entrer en compétition est étudiée. Il semble pertinent de s'intéresser à cette question car dans de nombreuses situations, notamment dans le monde du travail, les individus travaillent en équipe (pensez, par exemple, à la proportion d'articles de recherche qui sont co-écrits). Un autre pan de la littérature étudie, en outre, l'influence d'une prise de décision en groupe plutôt qu'individuelle sur les comportements (Cooper & Kagel (2005), Kocher & Sutter (2005), Sutter (2009), Luhan *et al.* (2009), Bornstein & Yaniv (1998)...). Il apparaît ainsi pertinent de s'interroger sur l'effet de la compétition en équipe.

Le **premier chapitre** de cette thèse est le fruit d'une collaboration avec Guillaume Hollard. Il traite de la calibration, c'est-à-dire de la confiance qu'un individu place dans ses connaissances. Dans une expérience typique de calibration, on demande aux participants de donner des intervalles de confiance à 90% (une borne inférieure et une borne supérieure telles qu'ils sont sûrs à 90% que la réponse correcte est comprise entre ces deux valeurs) pour un ensemble de questions. Par exemple, si la question concerne l'âge auquel Martin Luther King est mort et qu'un participant donne l'intervalle [45,70], cela signifie qu'il pense qu'il y a 90% de chances pour que Martin Luther King soit mort entre 45 et 70 ans. Un des résultats principaux de cette littérature est que les individus ont tendance à être surconfiants quand on leur demande de fournir des intervalles de confiance à un niveau donné pour un ensemble de questions de culture générale. Ainsi, bien moins de 90% des réponses correctes appatiennent aux intervalles à 90% du sujet moyen qui est de ce fait considéré comme "miscalibré". Les résultats expérimentaux suggèrent que la miscalibration a des conséquences économiques car les agents miscalibrés endurent des pertes sur les

marchés (Biais *et al.*, 2005, Bonnefon *et al.*, 2005). Nous proposons, dans ce premier chapitre, de mettre en place plusieurs incitations afin de réduire le biais de miscalibration. Les participants d'un premier groupe passent par une phase d'entrainement durant laquelle ils sont soumis à plusieurs incitations avant de remplir une tâche de calibration standard. Un second groupe de participants, le groupe de contrôle, remplit simplement la tâche de calibration. On compare ensuite la calibration des participants des deux groupes.

En accord avec la littérature, nos sujets font preuve de surconfiance dans leurs choix d'intervalles de confiance à 50% et 90%, puisque, respectivement moins de 50% et 90% des réponses correctes appartiennent aux intervalles fournis. A l'inverse, les intervalles à 10% sont trop larges et plus de 10% des réponses correctes tombent ainsi dans ces intervalles. Les incitations mises en place n'ont qu'un effet limité sur la miscalibration de nos participants. Les intervalles à 10%, 50% at 90% fournis par les participants masculins ayant suivi la phase d'entrainement sont légèrement plus larges que ceux des hommes du groupe de contrôle, mais ce n'est pas le cas pour les femmes. Cet effet de genre a amené une réflexion plus large sur les différences hommes-femmes de préférences qui pourraient expliquer la sous-représentation des femmes aux postes clés de la société.

Le **second chapitre** étudie l'impact du fait qu'une compétition oppose des équipes plutôt que des individus sur la décision d'entrer en compétition des hommes et des femmes.

L'idée principale du protocole expérimental est de tester le goût pour la compétition en offrant aux sujets le choix entre, d'une part, un mode de rémunération à la pièce (qui n'implique donc aucune compétition) et, d'autre part, un tournoi pour lequel le paiement dépend de la performance relative. Dans un premier temps, les participants ont un choix à faire entre une rémunération à la pièce et un tournoi individuel. Puis, les participants

ont à se décider en faveur d'une rémunération à la pièce ou d'un tournoi en équipe. Enfin, une dernière alternative à la rémunération à la pièce consiste en un tournoi en équipe pour lequel le participant sait qu'il sera associé à un coéquipier d'un niveau similaire au sien. Le goût pour les différents types de compétition peut alors être apprécié par la fréquence d'entrée dans chacun des tournois.

Deux résultats principaux émergent. Alors qu'en accord avec la littérature éxistante (Niederle & Vesterlund, 2007, Gupta *et al.*, 2005), les hommes choisissent nettement plus souvent que les femmes de sengager dans le tournoi individuel, lorsque l'équipe est constituée de deux partenaires tirés au sort, c'est-à-dire qu'un participant sait que s'il choisit le tournoi en équipe, son coéquipier sera aléatoirement choisi parmi les autres entrants, les femmes choisissent d'entrer dans le tournoi en équipe aussi souvent que les hommes. La parité parmi les candidats au tournoi est cependant obtenue parce que les hommes les plus performants refusent alors la compétition. Si l'on modifie la règle de constitution des équipes pour assurer aux sujets qu'ils seront appariés avec un partenaire du même niveau qu'eux, c'est-à-dire avec la personne dont la performance passée est la plus proche de la leur parmi les entrants au tournoi, les hommes les plus performants choisissent à nouveau massivement d'entrer dans le tournoi en équipe. La compétition en équipe permet donc d'obtenir la parité sans détériorer la qualité des candidats au tournoi à condition que l'on assure les participants que leur coéquipier a un niveau de performance proche du leur.

Les femmes semblent, quant à elles, indifférentes aux modalités de la compétition. Qu'il s'agisse d'une compétition individuelle ou en équipe, leur goût pour la compétition reste le même. Ces résultats confirment l'existence d'une forte différence entre hommes et femmes relativement au goût pour la compétition et mettent l'accent sur l'importance du mode de

constitution des équipes.

Le **troisième chapitre** constitue une extension du second. Il examine l'effet de l'identité sociale sur les comportements compétitifs des hommes et des femmes. En effet, alors que la théorie économique standard considère que la plupart des décisions émanent d'individus isolés, Akerlof & Kranton (2000, 2002, 2005) ont montré les conséquences économiques de l'identité sociale. Il est en outre plus réaliste de faire l'hypothèse que les membres d'une équipe décidant de s'engager dans une compétition partagent une identité commune (membres d'une équipe de sport, employés d'une même entreprise...). Dans l'expérience reportée dans le troisième chapitre de cette thèse, les participants sont aléatoirement séparés en deux groupes et participent à des activités destinées à faire émerger un sentiment d'appartenance au groupe pour lesquelles les membres d'un même groupe peuvent communiquer entre eux au moyen d'un système de messagerie instantanée. En dehors de ces activités de groupe, le protocole expérimental est calqué sur celui du second chapitre: les participants sont confrontés aux mêmes choix mais, lorsqu'ils choisissent de s'engager dans un tournoi, leur(s) adversaire(s) appartiennent à l'autre groupe et, dans le cas de la compétition en équipe, leur coéquipier est membre du même groupe qu'eux.

Le résultat principal est que les hommes performants qui étaient réticents à entrer dans le tournoi en équipe quand ils ignoraient le niveau de performance de leur coéquipier et que celui-ci était un participant inconnu, sont prêts à le faire s'ils partagent avec ce coéquipier une identité de groupe. Il apparaît ainsi que les hommes performants ne sont prêts à entrer en compétition en équipe qu'à condition que leur coéquipier soit au moins aussi performant qu'eux ou qu'il fasse partie du même groupe social qu'eux.

General Introduction

Why an experimental study on gender?

Gender gaps in wages and social positions are observed on all labor markets of western societies. One of the most frequently cited finding is that of Bertrand & Hallock (2001) who found, using a large sample of US firms, that women only represent 2.5 percent of the highest paid executives. In 1998, the median weakly outcome of women employed full-time was only 76% of that of men (Bowler, 1999). These gender differences also apply in politics as Fox & Lawless (2004) found that, controlling for personal characteristics and professional qualifications, women express significantly lower levels of political ambition to hold elective office than men do.

While two potential explanations for these gender gaps are a gender difference in ability to hold managerial positions or discrimination against women, a recent literature is interested in gender differences in preferences (Croson & Gneezy, 2009). Indeed, if women do not like to take as much risk as men or if they differ in regard to fairness or competitiveness considerations, they will not apply as often to the positions which involve high risk levels or a lot of competition. As those are the jobs that come with high wages and responsabilities, women will be under-represented in these kinds of jobs. Men and women have for instance

been found to differ in regard to social preferences (Andreoni & Vesterlund, 2001) and risk attitude (see Eckel & Grossman (2008b) for a survey [2]). In this dissertation, gender differences in self-confidence and propensity to self-select into competitive environments are the main focuses of interest as they may well have an important role to play in explaining the under-representation of women at the top of hierarchies.

While it is probably illusory to hope to completely disentangle the many factors that may cause men and women to react differently towards competitive environments, one can certainly get a better understanding at what determines men and women's decision whether to self-select into those environments. It may indeed provide solutions to get a more gender-balanced pool of candidates to top-level social positions. While some may consider parity to be an objective per se, it may also well be a requirement in order to get the best possible candidates, regardless of their gender, apply to, and in consequence hold, high-level positions in the society.

In this introduction, after having exposed the advantages and drawbacks of experimental economics as a tool to study gender differences in competitive preferences, a survey of the experimental literature on gender differences in self-confidence and willingness to compete or, more generally, seek challenges is provided. A section is then devoted to results which shed light on the origins of these gender differences and the nature vs nurture debate is exposed. The following section is interested in experiments proposing ways to reduce the gender gap in competitiveness. Finally, an outline of the dissertation is given and an abstract of each of the three chapters is provided.

2. Some studies found no differences in risk attitude, but the ones that do, find women to be more risk averse than men.

0.6. Advantages and drawbacks of experimental economics

Experimental economics has proven to be a useful tool to study these kinds of matter as it allows to control for many factors and one can therefore isolate one particular explanation for a given observed behavior. It is all the more important that many factors may play a role in explaining the gender gap in outcomes and managerial positions and they are impossible to disentangle by simply observing what happens on the labor market. If one notices that there are far fewer men than women holding managerial positions, it may be for a number of reasons. Women may not have the qualities required to be successful in these kinds of jobs or they may be discriminated against. It may also be the case that women do not wish to apply to positions which come with very long hours at work because they value the time spent with their family more than men do or that they view themselves as not good enough to stand a chance against men... However, studying the job market will only provide information about those few women who hold top-level positions but it is impossible to know the reasons why the one that did not make it did not. In the lab, subjects are required to participate in an hour-long experiment and make decisions in a very precise context. This allows to rule out several potential explanations for an observed behavior. For instance, if women are found to make less challenging choices in the lab, it cannot be due to their desire to spend time with their children, neither can it be attributed to their fear of being discriminated against (unless the experiment is about discrimination)...

As lab experiments obviously require to broadly simplify the context in which decisions are made, it can sometimes be objected that one cannot draw conclusions about what

would happen in the real world from decisions made in such artificial conditions. One therefore has to be careful when designing experiments so as being able to connect her results to real-world concerns.

0.7. Gender differences in self-confidence, competitiveness and need for challenges: A review of experimental results

A recent literature is interested in how men and women differ in regard to self-confidence and competitive behavior. In most of the studies dealing with gender and self-confident, men are found to be more confident than women, or more precisely more overconfident since both men and women seem to exhibit overconfidence. Not only are men more overconfident than women, they are also significantly more likely than women to enter competitive environment and gender differences in performance, overconfidence or risk attitude are not sufficient to explain their extra competitiveness when in comparison to women. However, results also suggest that women do not reject competition altogether and are responsive to incentives.

Countless studies claim that most individuals display overconfidence and provide evidence supposed to support this claim (The most cited of these studies is Svenson (1981)). Benoit & Dubra (2009) show that many of the examples cited in the literature do not actually qualify as evidence of overconfidence. Indeed, it may be perfectly rational for a majority of individuals to believe they are better than average after updating their beliefs following the reception of a signal on their ability. However, there are some research

which do find evidence of overconfidence that cannot be rationalized so easily and the over-attribution of behaviors to overconfidence cannot explain the gender differences which are often reported.

People are found to be more overconfident when they feel competent (Heath & Tversky, 1991). According to a number of studies, men are more overconfident than women (even though women also tend to display overconfidence). Prince (1993) shows that men tend to feel more competent in financial matters than women do. 43% of women and 75% of men in Niederle & Vesterlund (2007) believe they are among the 25% top-performers in an addition task suggesting both men and women are overconfident but that men are to a greater extent. The gender gap in confidence results in a gender gap in actions which has, in turn, consequences in terms of outcomes. Indeed, Barber & Odean (2001) found that, due to a higher level of overconfidence, men trade more than women and, in turn, they decrease their returns more than women do.

An entire literature deals with confidence in one's knowledge, which is called calibration, and conflicting evidence exist on whether men exhibit more overconfidence than women in this matter. While Lichtenstein & Fischhoff (1981) found no gender differences in calibration of knowledge, Lundeberg *et al.* (1994)'s results show that men are more likely than women to assess high levels of confidence in their knowledge when they are wrong. Furthermore, Lundeberg *et al.* (1994) claim that gender differences in calibration depend on the type of questions and are stronger for those perceived to be on the masculine domain. Pallier (2003)'s results also suggest that men are more confident in their own knowledge. However, using an incentive-compatible mechanism, Blavatskyy (2009) found that subjects actually exhibit on average underconfidence on their own knowledge and do not report any

gender differences. In a task where subjects have to provide confidence intervals, Cesarini *et al.* (2006) even finds women to be slightly more overconfident.

A literature on gender differences in willingness to enter competitions and more generally in the propensity to seek challenges has also developped these last past years. It allows to explore a possible explanation for the gender wage gap and the weak proportion of women holding top-level positions in firms and, more generally, in the society.

Bengtsson *et al.* (2005) exploit the answers to an exam where a student can only improve her grade by answering a fifth question if she succeeded very well in the first four questions. Men are more likely than women to answer the fifth question both in the subgroup of student who answered very well the first four questions and in the subgroup of student who did not do very well in the first questions and therefore could not improve their grade by answering the fifth question. Nevertheless, the gender difference in the propensity to answer the fifth question is larger in the second (mediocre) subgroup. This tends to show that high-performing women were insufficiently bold to try to answer the fifth question in comparison with men and, to a greater extent, low-performing men were inefficiently too prone to give the last question a try, again when comparing to women.

Page *et al.* (2007)'s experiment replicate some features of educational choices. Participants have to solve a given number of anagramms in order to move to the next stage. Furthermore, twice during the experiment, participants are given the choice to either stop and get their current payoffs or continue to the next level (which is composed of several stages) which is more difficult than the previous one. If a participant chooses to continue to the next level and fails, her payoffs will be less than what she would have received had she stopped at the previous level. In order to represent different aspiration levels, two

treatments are implemented: a gain framing treatment (low level of aspiration) and a loss framing one (high level of aspiration). In both treatments, males choose to continue to the next level more often than females. While the authors expected the performance to be higher in the loss treatment than in the gain treatment, this is only true for men which suggests that the increased marginal utility from a higher performance due to loss aversion has an effect on men but none on women. A parallel can be drawn with the results of Gneezy *et al.* (2003), Gneezy & Rustichini (2004), Ors *et al.* (2008) that men improve their performance when subjected to the pressure of competition while women do not.

Niederle & Yestrumskas (2007) observe that, controlling for performance, when given the choice between an easy and a hard task, men are 50% more likely than women to choose the hard task.

Niederle & Vesterlund (2007) and Gupta *et al.* (2005) find women to be significantly less likely than men to enter a tournament when having to choose between a tournament and a piece rate compensation scheme. Gender differences in confidence and attitude towards risk both play a role in the observed gender gap in tournament entry but at least part of it seems to come from a difference in how men and women like to evolve in a competitive environment. In comparison with the choices which would have maximized their expected payoffs, low-performing men self-select too often into the competition while high-performing women do not enter the tournament enough.

Furthermore, learning more about the roots of these gender differences in preferences may help find out ways to overcome them or minimize their harmful consequences. One may for instance be interested in the extent to which those preferences are shaped by nurture as opposed to nature.

0.8. Nature or nurture: On the origins of preferences

Whether men and women are intrisically different in regard to overconfidence, risk attitude and competitive behaviors or education and culture play an important role in explaining the observed gender differences is of crucial importance. Indeed, this will greatly determine the extent to which changes in institutions can have an impact on the gender gap in competitiveness and, maybe more importantly, whether it is possible to induce high-performing women to compete while discouraging men of low ability to do so. The following studies try to disentangle nature (hormones rates) from nurture (gender roles in the society, single-sex vs mixed education) in what determines competitiveness. As one could have expected, existing studies suggest both nature and nurture are important in determining one's competitive behavior.

Gneezy *et al.* (2008) tackle this question by studying the competitive behaviors of men and women from a matrilineal (the Khasi fom India) and a patriarchal society (the Maasai from Tanzania). They find that, while Maasai men choose to compete almost twice as often as women Maasai, the opposite is true in the Khasi society where women are found to be more competitive than men. These results cannot allow one to draw the definite conclusion that nurture explains the gender differences in competitiveness as genetics might explain both why a society is matrilineal or patriarchal and the gender gap in competitiveness. However, it certainly gives some credit to the hypothesis that culture might be very important in determining competitive behaviors.

Booth & Nolen (2009) try to disentangle nature and nurture's role in determining competitiveness by comparing willingness to compete of children from single-sex and coeduca-

tional publicly-funded schools. It is indeed unlikely that there is much genetic differences between children who attend the two different types of schools. They find that girls from single-sex schools to make more competitive choices than girls who attend coed schools. This result holds in the context of mixed-sex competition. This in line with the gender identity theory that women and men may act in order to conform to the stereotype of how a boy or girl should behave. Indeed, girls may feel less pressured to behave as girls should when they are not confronted to boys. These results support the idea that culture plays a great role in conditioning attitudes towards competition.

Another study sheds light on the importance of culture in determining gender differences in math ability which is often thought of as being innate. Guiso *et al.* (2008) show that the gender gap in mathematics and gender equality in a given society, as measured by the World Economic Forum's Gender Gap Index and answers to the World Value Surveys, are correlated and that the gender difference in ability in mathematics tends to disappear in more gender-equal countries.

However, not all evidence favor the nurture hypothesis. Buser (2009) has a clear-cut way of showing nature is also important in determining people's competitiveness by finding that the observed levels of sex hormones correlate with women's willingness to compete. In the same vein, Sapienza *et al.* (2009) find that people with high levels of testosterone are more likely to choose risky careers in finance. Furthermore, a literature on how the 2nd to 4th digit ratio (that is, the ratio of the length of the index finger to the length of the ring finger) which is a raw measure of in-utero exposure to testosterone is linked with assertiveness in women (Wilson, 1983), soccer ability in men (Manning & Taylor, 2001) and sporting ability in women (Paul *et al.*, 2006), as well as with many other traits, has

rapidly developped recently. Coates *et al.* (2009) show that the 2nd to 4th digit ratio predicts male traders' long-term profits as well as how many years they stay in business. To my knowledge, there as been no study so far on how the 2nd to 4th digit ratio relates to competitiveness but this might provide additional evidence of the role of hormones, and therefore nature, on the gender gap in willingness to compete.

Using data on identical and non-identical twins, Barnea *et al.* (2009) find that investment behaviors of twins are significantly correlated even in the case of twins who were not raised together and conclude that up to 45% of the heterogeneity in investment behavior can be explained by a genetic factor.

It therefore seems that neither nature nor nurture can explain alone the differences in how men and women react in competitive environment. In consequence, there is probably room for modifying competitive behaviors through changes in institutions and incentives. This may help reduce the gender gap in competitiveness and get the best candidates to self-select into competitions and in consequence win them and hold top-level positions in the society.

0.9. Policy implications

It is worthwhile to wonder whether one should try to reduce the gender gap in willingness to compete and seek challenges and bring women to apply more to high level positions. Indeed, if women prefer not to apply to these positions, it may not be socially desirable to try to go against their will. However, they are two main reasons why attempting to reduce the gender gap in competitiveness may make the society better off. Firstly, having more women at the top of hierarchy might be desirable per se. Studies have found that

firms benefit from having women in their board of directors and that it helps them go through the financial crisis (Erkut, 2006, Ferrary, 2008). Secondly, urging high-performing women to enter competitions more often and discouraging men of low ability to do so would improve the quality of the pool of candidates and, in turn, the average performance of the winners would also increase. Both arguments are likely to enter the social planner's welfare function and motivate the reflection on the changes in institutions that may help both getting a more gender-balanced pool of applicants to high-level positions and have the better contestants to self-select into competitions.

Experimental results indicate that both men and women's competitive behaviors can be change through incentives or modifications in institutions.

Firstly, it cannot be said that women do not respond to incentives. Increasing the expected payoffs from entering the tournament in comparison with choosing the piece rate compensation schme, Gupta *et al.* (2005) find that both men and women choose the tournament more often. However, the gender gap remains strong and significant.

Niederle & Yestrumskas (2007) investigate how a change in institutions may make men and women more similar in their choices for challenges. After having performed a task once, women tend to choose the easy task more often than men when given the choice between an easy and a hard task for two subsequent tasks. When participants only have to make their choice for the second task with the possibility of changing their choice for the third one, both high-performing men and women choose the hard task. It thus appears that high-performing women are not repelled by the hard task per se, but they seem more uncertain on their ability to do well in the hard task than men.

Another way of getting women to choose to enter competitive behavior is to increase

their chances of winning in comparison with men. Niederle *et al.* (2008) study the impact of affirmative action on men and women's decision to enter a competition. When it is required that at least one of two winners of a competition will be a woman, more women and less men choose to enter the competition and the response exceeds what would be expected from the change in the probability of winning. Both the fact that affirmative action makes the competition more gender-specific (For a women, beating other women is sufficient to secure a seat among the winners while a man has to be better than all other men to have a chance of winning the competition.) and the simple mention of affirmative action help explain the result.

These experimental evidence prove that women are not against competing altogether and that there exist ways to entice them to self-select into competitive environments.

0.10. Outline of the dissertation

This dissertation is interested in the impact of incentives and design changes on decisions that are typically gender-dependent.

The first chapter constitutes an attempt at reducing overconfidence in people's knowledge, a widespread cognitive bias that has economic consequences. The two subsequent chapters deal with the gender gap in willingness to compete which has recently been the subject of a growing literature in experimental economics (Gneezy *et al.* (2003), Gneezy & Rustichini (2004), Gupta *et al.* (2005), Niederle & Vesterlund (2007), Niederle & Yestrumskas (2007), Niederle *et al.* (2008), Booth & Nolen (2009)...). Here, the impact of the competition being team-based rather than individual is investigated. This seems to be a relevant question as in numerous situations, notably on the job market, individuals work

in teams (think for example of the proportion of research papers which are co-authored). Furthermore, as another literature studies how having participants make decisions as part of teams rather than individually affects behaviors (Cooper & Kagel (2005), Kocher & Sutter (2005), Sutter (2009), Luhan *et al.* (2009), Bornstein & Yaniv (1998)...), it also seemed that team competition could valuably contribute to this line of research.

The **first chapter** of this dissertation is a joint work with Guillaume Hollard. It deals with calibration i.e one's confidence in his own knowledge. A main result of the calibration literature is that people tend to be overconfident when asked to provide confidence intervals for general knowledge questions. The average subject has a lot less than 90% of correct answers fall into the 90% confidence intervals he provided for a set of questions and is therefore considered miscalibrated. Experimental results suggest miscalibration has economic consequences as miscalibrated agents tend to suffer losses (Biais *et al.*, 2005, Bonnefon *et al.*, 2005). The first chapter proposes to provide a maximum of incentives to reduce miscalibration. As it represents the authors' first attempt at experimental economics, the design is not as sound as it should have been and does not allow to disentangle the effect of the different incentives implemented.

While, in line with the literature, our subjects are found to display overconfidence when asked to provide 50% and 90% confidence intervals, more than 10% of correct answers belong to the 10% intervals provided, showing that subjects exhibit underconfidence in their knowledge at the 10% level. The incentives we proposed only have a weak effect on participants' miscalibration. It somewhat reduces overconfident miscalibration but only for males. This gender effect, as weak as it may be, layed the foundations for the subsequent interest in gender differences which led to the two following chapters.

In a **second chapter**, the way team competition affects men and women's willingness to compete is investigated. Indeed, competitions often oppose teams rather than individuals.

The main result is that team competition succeeds in eliminating the gender gap in tournament entry which exists when participants have to choose whether to enter the individual competition. The elimination of the gender gap comes, surprisingly, from men opting out of the team tournament when they massively chose to enter the individual tournament. Women, on the other hand, do enter the tournament a bit more often when it is team-based but not significantly so.

The experimental design allows to disentangle the potential explanations for this result. Participants have to go through several tasks each of which corresponds to a choice between two remuneration schemes to apply to either a future or a past performance. The variations in the remuneration schemes available make it possible to infer from the choices the causes behind the changes in competitive behavior when the competition goes from being individual to being team-based. In particular, after having chosen whether they wanted to be paid according to a piece rate or a two vs two team tournament remuneration scheme, participants have to make a subsequent choice between a piece rate and a team tournament where they know their teammate will be of level close to their own while they had no information whatsoever on their teammate's ability in the previous choice.

The results indicate that the disappearance of the gender gap is in great part due to high-performing men opting out of the team tournament because they do not want to take the chance of losing the tournament because of a less able teammate. Indeed, high-performing men are perfectly willing to enter the team tournament when they know they will be matched with someone of level close to their own. Consequently, team competition

does not harm the quality of the pool of entrants, provided teams are formed according to the ability of their members.

The **third chapter** is a follow-up to the second one. It is interested in finding out the impact of group identity on men and women's competitive behavior. Indeed, people often act as members of social groups rather than as isolated individuals. Furthermore, it is more realistic to imagine that team members engaged in a competition share a common identity (think of members of a sport team, employees of a firm...). In the experiment reported in the third chapter, participants are randomly divided into two groups and go through group-identity-building activities involving communication through an instant message system. Apart from that, the experimental design is built on that of the second chapter: participants have to go through the same tasks but, if they choose to enter a tournament, their opponent(s) will belong to the other group and, in the case of team competition, their teammate will be a fellow group member.

The main finding is that high-performing men are no longer reluctant to enter the team tournament if they do not know the ability of their teammate when he or she is a fellow group member. It therefore appears that men are only willing to enter a team competition if they know their teammate is at least of ability equal to their own or if they both belong to the same social group.

Chapter 1

Incentives to Learn Calibration

This chapter is a joint work with Guillaume Hollard.

1.1. Introduction

In the past decades Economists and Psychologists documented a long list of biases, i.e. substantial and systematic deviations from the predictions of standard economic theory. Many economists will argue that these biases only matter if they survive in an economic environment. In other words, if correct incentives are provided, subjects should realize that they are making costly mistakes and then change the way they make such decisions in further decision tasks. In this chapter, we test this claim regarding a particular bias, namely miscalibration. We create an experimental setting that provides a lot of incentives (decisions have monetary consequences, successful others can be imitated, feedbacks are provided, repeated trials are used, etc). Finally, we test in a subsequent decision task whether subjects still display some miscalibration.

What is miscalibration and why is it important to economists?

Calibration is related to the capacity of an individual to choose a given level of risk. In a typical experiment designed to measure miscalibration, subjects are asked to provide subjective confidence intervals for a set of questions. For example, if the question is "What was the unemployment rate in France for the first trimester of 2007?" and the subject provides the 90% confidence interval [7%,15%], it means that the subject thinks that there is a 90% chance that this interval contains the correct answer. A perfectly calibrated subject's intervals should contain the correct answer 90% of the time. In fact, a robust finding is that almost *all* subjects are miscalibrated. On average, 90% subjective confidence intervals only contain the correct answer between, say, 30% and 50% of the time. [1] Glaser *et al.* (2005) found an even stronger miscalibration using professional traders.

Miscalibration is a bias having important economic consequences, since miscalibrated people suffer losses on experimental markets (Bonnefon *et al.*, 2005, Biais *et al.*, 2005). Furthermore, it is likely that such a pathology affects the behavior of real traders acting on real markets. Therefore, it does make sense for economists to try to reduce miscalibration and to study the best incentives to do so.

Lichtenstein & Fischhoff (1980) attempted to reduce miscalibration by providing subjects with feedback on their performance. They proved that *23 sessions*, each lasting about an hour, were required to substantially improve subjects' calibration. Several other psychologists have used various techniques to reduce miscalibration

1. see Lichtenstein & Fischhhoff (1977) for a survey and (Klayman *et al.*, 1999) for variables that affect miscalibration

(Pickhardt & Wallace, 1974, Adams & Adams, 1958), with little success so far. Miscalibration thus appears to be a very robust bias.

Since miscalibration is a bias linked to overconfidence, one could expect a difference in how men and women are affected by it. Indeed, Lundeberg *et al.* (1994) found men are generally more overconfident than women, even if this depends very much on the task. In the financial matter, Prince (1993) and Barber & Odean (2001) found men to exhibit more overconfident behaviors than women. As far as calibration per se is concerned, Pallier (2003)'s findings suggest that men are more confident in the accuracy of their knowledge. However, his way of measuring calibration is quite different from ours: his subjects have to answer multiple-choice questions and assess a level of confidence while ours have to provide confidence intervals at a specified level. These two types of calibration tasks are sufficiently different to produce distinct results.

This chapter proposes to provide a maximum of incentives to reduce miscalibration. As it constitutes one of the authors' first attempt at experiment economics, the design is not as sound as it should have been. In particular, it does not allow one to disentangle the effect of the several incentives implemented. The main result is that our experimental setting slightly reduces overconfident miscalibration but only for males. It could be the case that different incentives have an opposite effect on subjects' miscalibration which might explain the weakness of the results but our experimental design does not allow us to check for this possibility.

The remainder of the chapter is organized as follows. Section 2 presents the

experimental design. Section 3 presents the results and section 4 discusses them. Finally, Section 5 provides some concluding remarks.

1.2. Experimental design

The measure of miscalibration and associated overconfidence relies on a now standard protocol. Subjects have to provide 90% subjective confidence intervals for a set of 10 quiz questions. On average, perfectly calibrated subjects should catch the correct answer 9 times; if this is not the case, they are miscalibrated. The subjects are asked to estimate their hit rate. The difference between their estimated hit rate and their actual one is a classical measure of overconfidence. This protocol will thus serve as a benchmark for measuring miscalibration and overconfidence in our experiment.

The experimental subjects were divided into two groups. The subjects of the first group attended a training session and then performed a baseline treatment aiming at measuring their miscalibration according to the standard protocol. The principle of this training session is to offer a whole set of experimental incentives that enhance learning (monetary incentives, tournament, feedback, loss framing). The second group, the control group, performed the baseline treatment only.

At first glance, testing the effect of incentives seems possible by simply providing incentives for the basic miscalibration task used as a benchmark. This seems natural but cannot be implemented since there is no simple incentive scheme that rewards correct calibration. Think, for example, of an incentive scheme that would pay a

high reward if the difference between the required percentage of hit rates, say 90%, and the actual hit rate (measured over a set of 10 questions) is small. A rational subject can use very wide intervals for 9 questions and a very small one for the remaining question. He is thus certain to appear correctly calibrated, while he is not. Cesarini *et al.* (2006) chose to provide incentives for the evaluation of the calibration task only (Subjects had to guess how many correct answers belong to the intervals provided by the subject and by his peers) and made miscalibrated subjects go through the task again. We chose to consider a task similar to the calibration task in which we can provide the necessary incentives. This task, described in the following section aims at making the subjects realize they have a hard time calibrating the level of risk they wish to take. After having completed this training task, subjects have to complete a standard calibration task for which we only provide incentives for the subsequent self-evaluation of how subjects did in the calibration task as in Cesarini *et al.* (2006). A control group who did not go through the training task also completed the calibration task to enable us to measure the effect of the training task.

1.2.1. The training period

In the training period, the participants were asked to answer a set of twenty questions: ten questions on general knowledge followed by ten questions on economic knowledge.

The set of questions used in the training period was composed of ten questions

some of which were used in Biais *et al.* (2005)'s experiment plus 10 questions on economic culture. Half of the subjects had to answer the 20 questions in a given order, the other half saw the questions in reverse order. This enabled us to check for learning effects during the training period.

In this training period, the subjects were provided with a reference interval for each question that they could be 100% sure the correct answer belonged to. Subjects had to give an interval included in the reference interval. Each player received an initial endowment of 2000 ECUs (knowing that they would be converted into euros at the end of the experiment at the rate of 1 euro for 100 ECUs) before beginning to answer the questions but after having received instructions. They were told that 100 ECUs were at stake for each one of the twenty questions resulting in a loss framing. The payoffs are expressed in experimental currency (ECU). The payoff rule applied for each question was the following. :

$$\text{payment} = \begin{cases} -100 * \frac{\text{width of the interval provided}}{\text{width of the interval of reference}} & \text{if the correct answer belongs} \\ & \text{to the interval provided} \\ -100 & \text{otherwise} \end{cases}$$

According to this formula, the payoff is maximal and equal to 0 when the interval provided by the subject is a unique value, this value being the right answer to the question. In this case, the subject keeps the total 100 ECUs at stake for the question

considered.

The payoff is equal to -100 (the subject loses the 100 ECUs) if the subject provides the reference interval and consequently takes no risk at all.

There is therefore a trade-off between the risk taking and the amount of ECUs a subject could keep if the correct answer fell inside his interval. High risk taking is rewarded by a small loss (the subject keeps most of the ECUs at stake) in the case where the answer belongs to the interval provided. Conversely, a subject who only takes little risk will only keep a few ECUs (meaning he would lose most of the ECUs at stake) even if the correct answer does belong to his interval.

Subjects had 60 seconds to answer each question, indicated by a timer. We applied this time constraint so as to not make the fastest subjects wait too long before switching to the next question as all subjects had to have answered a question before moving to the next one to enable us to provide feedback about the intervals provided for a given question. Nevertheless, we picked the time limit corresponding to the time it took for most subjects to answer a question in the pilot experiment where there was no time constraint. When time was up, if the subject had not validated his interval, the 100 ECUs at stake were lost and the next question was put.

Subjects received feedback providing them with the intervals chosen by all the participants (including themselves) ranked by width from the narrower to the wider as well as the payoff corresponding to each interval. They could infer from this feedback whether they had taken too much risk compared to the others. They could

also see the ranking of everybody's score after each question so as to trigger a sense of competition [2].

After they had answered all 20 questions, subjects were asked to write a comment about their strategy. They then received general feedback about the first step of the experiment.

People being miscalibrated, we expected them to realize it when they saw that the correct answer fell outside their interval less or more often than they had expected, which resulted in a loss of money. As a result, we expected them to better adjust the level of risk they wished to take for the next questions. For instance, a subject quite confident that he knows the answer who provides in consequence a narrow interval will be likely to be more cautious when he realizes he did not catch the right answer. On the contrary, a subject who decides to be safe and provides a wide interval for a question he thinks he knows the answer to, will tend to be less cautious for the next questions when he realizes he could have kept more ECUs by giving a narrower interval. They could also infer information about the right level of risk to take by looking at what others did and how it paid.

In order to control for the role of risk aversion in explaining the behaviors in the training period and the calibration task, we should have had subjects of both treatments choose x between 0 and 100 knowing the payoffs would have been the following:

2. In order to enable us to disentangle the effect of the monetary incentives, social learning and competition we should have run different treatments: one where we only would have used monetary incentives, a second one with both monetary incentives and social learning and a third one with competition as well as monetary incentives and social learning.

$$\text{payment} = \begin{cases} -100 * \frac{x}{100} & \text{if a number randomly drawn} \\ & \text{between 0 and 100 is inferior to x} \\ -100 & \text{otherwise} \end{cases}$$

This task has the advantage of being as close as possible to the training task and as a result would have provided a good measure of risk attitude in the context of the experiment. Alternatively, we could have made subjects take the test of Holt & Laury (2002).

1.2.2. The standard calibration task

In the next stage, the subjects who had participated in the training period were asked to answer a set of ten questions (five questions on general knowledge followed by five questions on economic knowledge) by giving their best estimation of the answer and then by providing 10%, 50% and 90% confidence intervals. Subjects in the control group had to complete the same task. After the pilot experiment was run, we removed and replaced the most difficult questions for which subjects seemed to have no clue about the answer.

Before the beginning, subjects were explained in detail what were 10%, 50% and 90% confidence intervals. They were also told that they would receive remuneration regarding this task but that they would only know how the remuneration was established later. There was no feedback between the questions and subjects could proceed at their own pace.

1.2.3. Evaluation of miscalibration

As in Cesarini *et al.* (2006), the remuneration for the calibration tasks depended on the evaluation the subjects were asked to make afterwards of their and the average subject's performance during the calibration task. For instance, they were asked how many correct answers they thought fell inside the 10%, 50% and 90% confidence intervals they provided and how many correct answers fell inside the intervals given by the average subject.

After that, they were asked to make two choices between two bets. The first choice was between betting that at least one correct answer out of ten fell outside the subject's 90% intervals and betting that at least one correct answer fell inside the subject's 10% intervals. Each one of these bets would have a probability of $1\text{-}0.9^{10}$, close to 0.65 to be true for a perfectly calibrated subject. The second choice was between betting that, out of three questions randomly drawn from the ten questions, at least one correct answer belonged to the subject 50% intervals ($1\text{-}0.5^3=0.875$) and betting that the correct answer to a randomly chosen question belonged to the 90% interval provided by the subject (0.9). Each successful bet was rewarded by 300 extra ECUs. These bets were bound to inform us on how people are aware of their miscalibration.

1.3. Results

The experiment took place at the laboratory of experimental economics of the University of the Sorbonne (Paris 1) in July 2007. 87 subjects, most of whom were students, participated in the experiment. 53 students went through the training period before they completed the calibration task, while the control group was composed of 34 subjects. The average subject was 22.42 years old in the control group and 22.71 years old in the trained group. The proportion of men was respectively 41.18% and 41.5% in the control and the trained groups. The average earning was 11.16 euros. On average, subjects earned 10.62 euros including a 5 euros show-up fee in the control group and 14.24 euros (8.42 for the training period and 5.82 for the calibration task) with no show-up fee for the trained group.

In the following section, we distinguish between two measures of confidence. First, the difference between the actual hit rate and the required hit rate, for 10%, 50% and 90% confidence intervals. This difference measures the miscalibration. Second, the difference between the subject's estimated hit rate and his actual hit rate. This second difference represents the confidence for the calibration task. It is thus another a measure of overconfidence.

1.3.1. General results on calibration

We find that the subjects from the control group exhibit a high level of miscalibration. Indeed, a lot more than one correct answer out of ten belong to the 10% intervals while fewer than five correct answers out of ten fall inside the 50%

confidence intervals and far fewer than nine correct answers out of ten fall inside the 90% intervals. The average hit rates in the control group at the 10%, 50% and 90% levels are respectively 2.03, 3.32 and 4.81 while the corresponding median hit rates are respectively 2, 3 and 5. T-tests show that the observed hit rates significantly ($p<0.001$ for the 3 tests) differ from the expected hit rates (respectively 1, 5 and 9 at the 10%, 50% and 90% levels).

At the 10% level, people are found to be under-confident, meaning that they provide too wide intervals. As a result, the correct answer belongs too often to the 10% intervals. This result was expected by Cesarini *et al.* (2006).

At the 50% and 90% levels conversely, subjects display overconfidence as their intervals are too narrow, this is all the more the case for 90% confidence intervals. The fact that far fewer than 90% of correct answers belong to the 90% confidence intervals of the subjects is in line with the results of Glaser *et al.* (2005).

A surprising feature is that, when asked to evaluate how many correct answers belong to their intervals, the average answers are respectively at the 10%, 50% and 90% levels: 3.47, 5.56 and 8.04 for the control group; subjects exhibit overconfidence for the calibration task, thinking that they were more cautious than they actually were (see Figure 1). Let us, nevertheless, observe that subjects do predict that their calibration is far from being perfect, otherwise their evaluations would have been 1, 5 and 9.

These results indicate that not only are people unable to adjust the width of their intervals to the risk level indicated (they are miscalibrated) but they are also unable

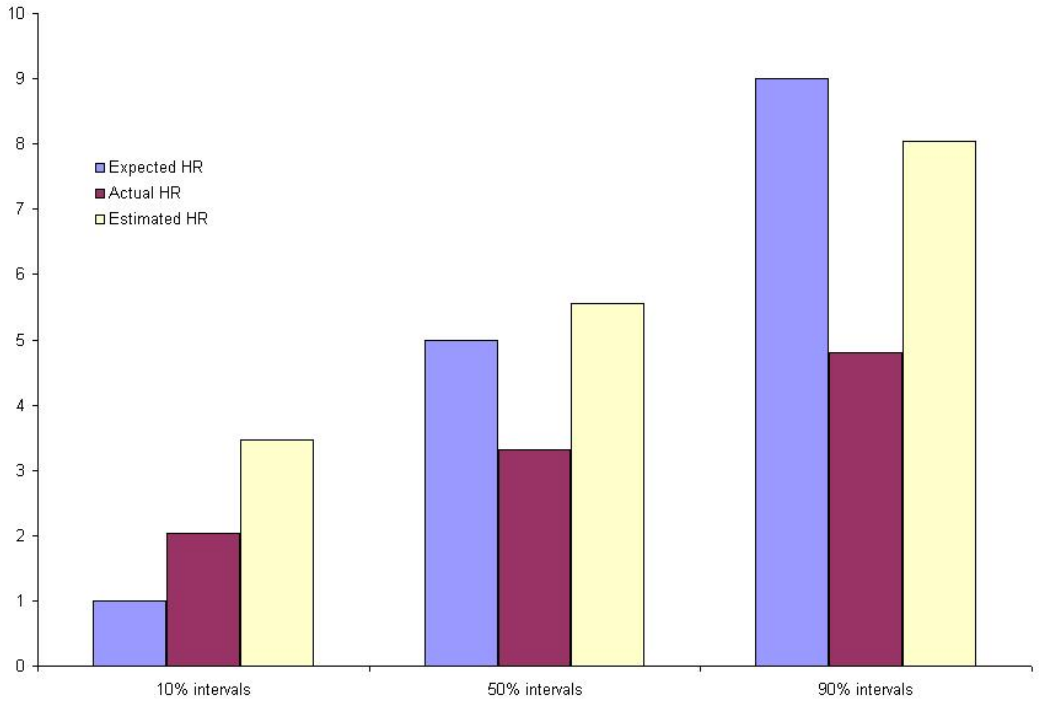

Figure 1.1. Expected, Actual and Estimated Hit Rates in the Control Group

to predict their bias correctly (they are over or under-confident). Nevertheless, they seem aware of the fact that they provide too wide 10% intervals and too narrow 90% intervals.

The choices of bets indicate that subjects are more aware of their 10% overcautious miscalibration than they are of their 90% overconfident miscalibration. Indeed, subjects chose much more often to bet that at least one correct answer fell inside of their 10% intervals than that at least one correct answer fell outside of their 90% intervals. However, given the actual hit rates, the first choice provided a 99.84%

chance of winning while the second possibility offered a 91.77% probability of success. As for the second choice, half the subjects chose to bet that, out of three questions randomly drawn from the ten questions, at least one correct answer belonged to the subject 50% intervals while the other half chose to bet that the correct answer to a randomly chosen question belonged to the 90% interval provided by the subject. Given the actual hit rates, the first bet provided a 74.27% chance of success, while the secong bet provided a 52.4% probability of winning. Once again, people seem not to be aware of the extent of their miscalibration at the 90% level.

To sum up, people seem to overestimate their underconfidence and underestimate their overconfidence.

1.3.2. The effect of training on miscalibration and confidence in calibration

1.3.2.1. The general picture

The main purpose of this chapter was to see whether a training period during which several incentives aiming at improving people's calibration as well as decreasing overconfidence were provided would be efficient.

Trained subjects have only slightly higher hit rates at the 10%, 50% and 90% level than subjects from the control group (see figure 2). The differences in hit rates between the control and the trained group are not significantly different at any reasonable level. [3]

3. The hit rates are respectively at the 10%, 50% and 90% levels 2.03, 3.32 and 4.81 for the control group and 2.40, 3.80 and 5.33 for the trained group. To get an idea of levels of miscalibration found in other studies, notice that Russo & Schoemaker (1992) obtained hit rates at the 90% level between 4.2 and 6.2, while Klayman *et al.* (1999) found 4.3. However, the level of miscalibration is obviously very sensitive to the set of questions used. Since half the questions we used were taken from Biais et al [2005], we can

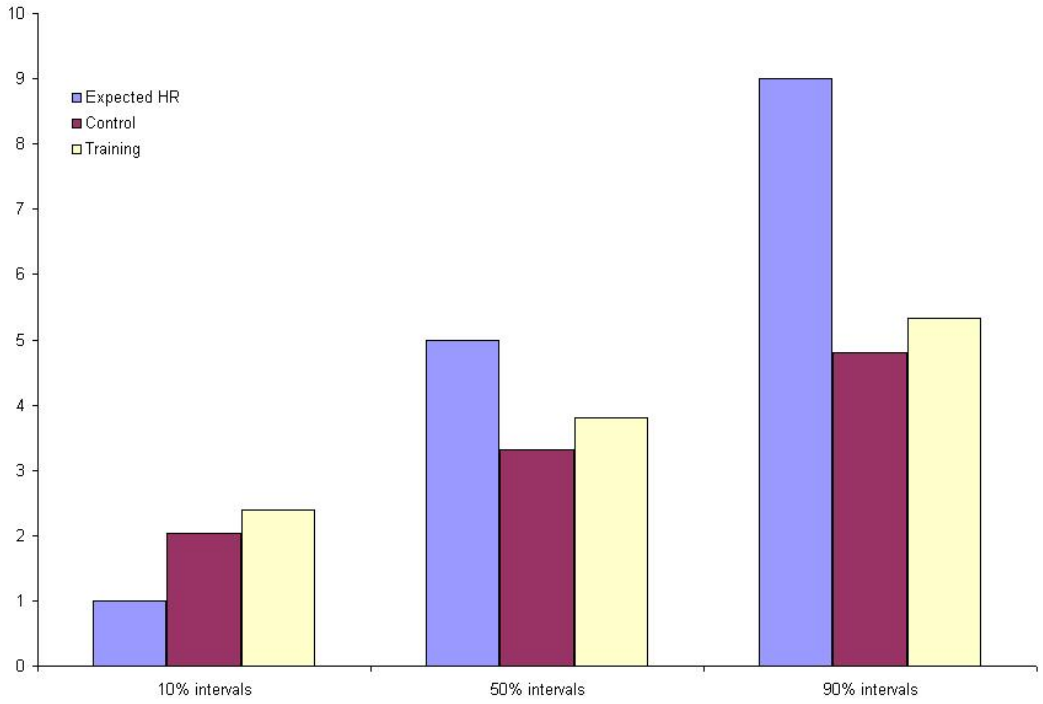

Figure 1.2. Hit Rates: Control vs Trained Group

We find that the median 10% interval width is larger for the trained group than for the control group for 7 questions out of ten. For the 3 remaining questions, the median width of intervals is equal across treatments. Note that this goes in the sense of a worsening of the underconfident miscalibration observed at 10% as people tend to provide too wide intervals at 10%.

The same result is found when we compare median widths of 50% intervals (wider

compare the level of miscalibration we found to those of that study. Using no incentive, the average 90% hit rate in their study is 3.6 while we find respectively 4.8 and 5.3 in our control (where subjetcs no they will get a payment but have to wait until the end of the calibration task to find out how it will be calculated) and training (where subjects are in the same situation and previously went through the training period) group. It therefore seems that the presence of incentives does increase hit rates.

intervals in the trained group than in the control group for 7 questions, the reverse for 1 question and equal median intervals across treatments for the 2 remaining questions). As for 90% intervals, for six questions out of ten the interval width is larger for the trained group while the control group provided wider intervals than the trained group for 1 question. [4]

1.3.2.2. A different impact between genders

This general picture masks some heterogeneity across subjects. We can control for several sources of heterogeneity. However, the gender variable captures almost all of it. We observe indeed that there is virtually no improvement in women's calibration especially when we compare the median hit rates between the treatments while men increase their median hit rate by 0.5 point at the 50% level and by 1 point at the 10% and 90% levels (see Figure 3).

The difference in interval width between the control and the training treatments seems to be larger for men than for women, indicating that men learned more than women to reduce their overconfidence. Using a Wilcoxon-Mann-Whitney test, we find that 10% confidence intervals are significantly wider for the trained group respectively for five questions out of ten and zero question out of ten for men and women.

4. If we compare average interval widths, which seems less relevant as averages are sensitive to extreme values, we find that for 7 (6) questions out of ten the average width of 10% and 50% (respectively 90%) intervals are larger for the trained subjects, while for the remaining 3 (respectively 4) questions, the opposite is true.
Checking for the significance of these results with a T-test, we find significantly larger intervals for the trained group than for the control group only for the ninth question, all other differences being not significant. However, as variances of interval widths are often very different across the control and trained group and as a way of eliminating the influence of extreme values, we ran a Wilcoxon-Mann-Whitney test. We found that the 90% interval widths are significantly different (either at the 1%, 5% or 10% levels) for 5 questions out of ten while 10% and 50% intervals widths are significantly different respectively for 3 and 6 questions out of ten.

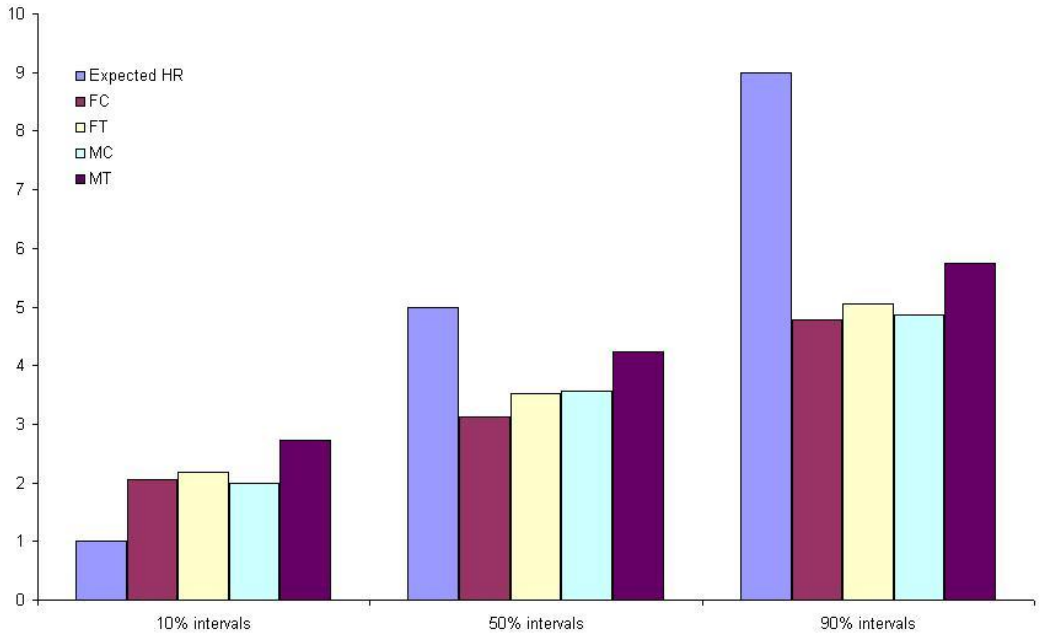

Figure 1.3. Hit Rates: Expected, Female Control (FC), Female Training (FT), Male Control (MC) and Male Training (MT)

Let us notice that in the trained group both men and women had more than one correct answer inside their 10% intervals exhibiting underconfident miscalibration. As a result, an increase of 10% intervals causes an aggravation of underconfidence. For 50% intervals, the width increases significantly between the control and the training treatments respectively for two and six questions out of ten. Finally, concerning 90% intervals, the difference is significant in three cases and four cases out of ten respectively for women and men.

It may be interesting to study the link between the "theoretical" distribution of

hit rates of a perfectly calibrated subject (who has a 90% chance for an answer to fall into any of his 90% confidence intervals...) and the one we actually observe. We report two figures showing the theoretical and actual distributions of 90% intervals hit rates for women and men. Those figures make miscalibration very prominent. We then ran a two-sample median test, separately for women and men, on the distributions of hit rates in the control and the training groups. We find that our training has a significant effect on men's 90% calibration (p=0.089) while no significant effect is found for women. Men's 90% calibration is improved by our training which can be seen on figure 1 by the shift in the distributions of hit rates between the control and the training treatments. No effect is found for miscalibration at the 10% and 50% levels.

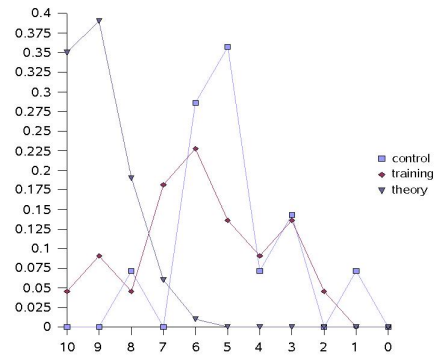

Figure 1.4. Theoretical hit rates and actual hit rates of men from control and trained group.

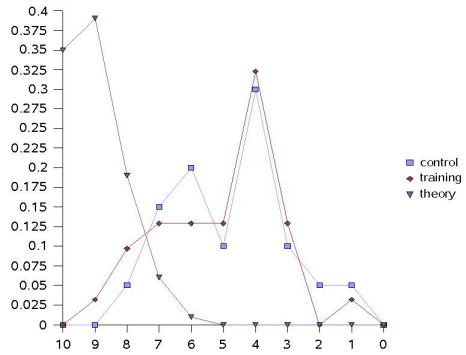

Figure 1.5. Theoretical hit rates and actual hit rates of women from control and trained group.

1.3.3. What happened during the training session ?

The training period seems to have had some impact on men but almost no effect on women. It could be interesting to use the results from the training period to get

an insight into the nature of the learning process that arose. In order to be able to measure learning during the training period, the order of the 20 questions was reversed for half of the subjects.

It appears that during the training process, some learning took place. We measured learning at this stage by comparing the width of the intervals provided for the same question by subjects from the two groups corresponding to the two orders of appearance of the questions. We found that there was a significant difference in the width of the intervals between the two groups for seven questions out of twenty, each going in the sense of longer intervals for the group who answered the question later in the training session. For example, the intervals provided for question 18 were wider for the group who had the regular order of questions than for those who had the reversed order (for whom question 18 was actually the third one they had to answer). It seems noteworthy that six out of the seven questions which subjects with more training answered with wider intervals were economic knowledge questions.

We regressed a variable equal to the interval width chosen over the interval width of the interval of reference on the intercept, a dummy indicating the gender ("Female"),the age, the level of education, a dummy indicating whether the question appeared early during the training session ("Exp"), the interaction between "Exp" and "Female" ("Exp*Female"), the ranking announced to the subject after he had answered the previous question ("Rank-1"),the gap between the midpoint of the interval provided and the correct answer divided by the correct answer as a proxy for the ignorance ("Gap") and dummies for the different questions (See Table 3). We

added "Gap" in the regressors so as to take in the effect of knowledge on the choice of the interval width. Any residual effect of "Rank-1" can therefore be attributed to competition, i.e. the effect of the announced rank on the decision to take more or less risk.

Table 1.1. OLS regression of IW/IWref and logistic regression of ICA)

Variable	IW/IWref	ICA	Variable	IW/IWref	ICA
Intercept	41.12421	1.2527	q8	-1.68538	-0.0629
	(<.0001)	(0.2431)		(0.8203)	(0.9491)
Female	6.99129	-0.1719	q9	-19.85722	0.8560
	(<.0001)	(0.4594)		(0.0076)	(0.3943)
Age	-0.46804	-0.00749	q10	-11.83878	0.3414
	(0.0011)	(0.7437)		(0.1108)	(0.7303)
Education	0.31946	-0.0545	q11	5.27825	0.1627
	(0.4400)	(0.3976)		(0.4797)	(0.8694)
Exp	2.47820	0.4154	q12	-6.28333	-0.6213
	(0.0622)	(0.0473)		(0.3983)	(0.5272)
Exp*Female	0.12668	1.0866	q13	-5.66640	1.0783
	(0.9512)	(0.0007)		(0.4491)	(0.3119)
Gap	1.95204	-0.8905	q14	-6.67250	-0.0545
	(<.0001)	(<.0001)		(0.3686)	(0.9558)
Rang_1	0.80443	-0.0154	q15	-16.97609	0.5789
	(0.0018)	(0.6979)		(0.0223)	(0.5612)
q2	-23.23853	5.4903	q16	-11.00649	0.4695
	(0.0041)	(<.0001)		(0.1385)	(0.6355)
q3	5.05854	0.0202	q17	-8.28099	0.2700
	(0.4957)	(0.9836)		(0.2645)	(0.7845)
q4	2.15180	0.4241	q18	-14.72562	1.6759
	(0.7724)	(0.6688)		(0.0476)	(0.1118)
q5	3.09015	0.1231	q19	-20.02148	0.9432
	(0.6770)	(0.9007)		(0.0071)	(0.3492)
q6	-1.74616	0.7506	q20	-9.39033	2.4406
	(0.8140)	(0.4522)		(0.2106)	(0.0269)
q7	-17.73803	2.4098			
	(0.0180)	(0.0253)			

Note: p-values are in brackets.

Women are found to provide significantly (p-value<0.0001) wider intervals than men. "Age" is also highly significant and negative. "Exp" is positive and signif-

icant (p-value=0.0622) indicating that subjects who answered a question later in the training period tend to provide wider intervals. We found that the coefficient of "Gap" is positive and highly significant showing that the less people knew the answer, the wider the interval they provided. The coefficient of "Rank-1" was found to be positive and highly significant too. It seems that the announcement of a bad ranking leads subjects to take less risk and provide wider intervals.

The logistic regression of the probability to catch the correct answer in one's interval (ICA) on the same variables (See Table 3) reveals that while "Female" "Age" and "Rank-1" are not significant, "Gap" is negative and highly significant showing that the more ignorant the subject was about the answer, the less chance for the correct answer to belong to his interval. "Exp" is found to be positive (p-value=0.0473) and "Exp*Female" positive (p-value=0.0007) indicating that, overall, having answered a greater number of questions previously tends to increase one's chances to catch the correct answer in his interval but this is true to a bigger extent for women. We tried to search for explanations for the fact that women failed to learn from our training period while men did. It seems likely that the explanation lies in what happens in the training period. The different possible explanations are: a stronger reaction to competition for men than for women, a longer time for decision, the fact that money is a stronger incentive for men... Unfortunately, the too scarce data available to us made it impossible to reach a definitive conclusion. Our results could indicate that men used more the training session to experiment different strategies and took more risk to go up in the ranking and, as a result, benefited more

from the training period than women who were more cautious. This is in line with the idea of Barb Magio, a trader explaining in Gail Osten's book, *What Can Male Traders Learn from Successful Women...And Vice Versa* that "women, particularly when starting out, often are more timid in trading and more conservative in the use of their money". "Men, on the other hand, seem not to have the same reservation or feeling of guilt regarding their initial funding or the price of tuition". "They take these losses merely as part of the learning process and seem to feel less guilt or necessity to explain why instant profitability is lacking."

1.4. Discussion

This chapter contributes to a literature interested in cognitive biases having economic consequences. We focus on miscalibration, a very robust bias correlated with losses on experimental financial markets and bad entrepreneurship.
In line with the existing literature on miscalibration, our subjects strongly suffer from the miscalibration bias, their 50% and 90% intervals being too narrow (overconfident miscalibration). We find that subject's 10% intervals are too wide (underconfident miscalibration). These results are widespread in the population according to the literature and there are very few exceptions. Furthermore, subjects overestimate their underconfidence and underestimate their overconfidence. Previous attempts to reduce miscalibration relied on very long and repetitive training periods.

We find that men's calibration can somewhat be improved by a thirty-minute training period punishing miscalibrated behavior by money losses, while women's

cannot. The incentives we implemented had no effect on women. This difference in the impact of monetary incentives between genders is a key interest of Niederle and her coauthors (Gneezy *et al.*, 2003, Niederle & Vesterlund, 2007, Niederle & Yestrumskas, 2007, Niederle *et al.*, 2008) who show that it can be detrimental to welfare. Indeed, they highlight the fact that highly able women do not enter tournaments as often as they should while low performing men enter too often. To overcome this issue, Niederle *et al.* (2008)studied the effect of affirmative action in favor of women and found that it increased the number of women willing to enter the tournament and decreased the number of men, more than what would be predicted solely by the change in the probability of winning. There are probably other incentives one could think of that would have a stronger effect on women than on men and which could therefore benefit welfare.

1.5. Conclusion

We find that people who went through the training session provide wider intervals at 10, 50 and 90% than those who did not. This result is not always significant but it is quite robust as subjects from the control group never provided significantly wider intervals than trained subjects. Moreover, our training significantly increases a subject's chance to catch the correct answer in his interval. This results in an improvement of calibration at the 50% and 90% levels but the underconfident miscalibration observed at the 10% level is made worse by the training. Nevertheless, men seem to have learned more from the training than women, as the increase in

interval width between the treatments is greater for men than for women in most cases. As a result, the difference in hit rates between the control and the trained group is greater for men, who become more cautious and increase their hit rates at the three levels while women's hit rates are virtually the same across treatments.

Some consequences can be drawn. It is unlikely that miscalibration disappears in a market environment, since we provided the kind of incentives that are expected on real markets. According to our results, real traders are likely to underestimate the risk they take when they think they invested in a very secure asset. Symmetrically they take less risks than they think when they invest in risky assets. So, the overall effect of miscalibration on real markets is ambiguous. Our results also suggest that men may be more successful in learning calibration.

This first chapter was the starting point of a reflection on gender differences in response to incentives which led to the two following chapters.

Instructions

Trained group

You are about to participate to an experiment aiming at evaluating your ability to calibrate risk. This experiment will be divided in several steps.

First step

In this first step, you will have to answer a set of twenty questions by providing an interval for each question. At the beginning of this step, you will be endowed with 2000 ECUs which will be converted to euros at the end of the experiment. For each of the 20 questions, 100 ECUs will be at stake. You will have to keep the more ECUs you can.

For each question, you will be provided with an interval of reference including the correct answer. The interval you will provide will have to be contained in the interval of reference. Your payoffs will be determined as follows:

- If the correct answer does not belong to the interval chosen, you will lose the 100 ECUs at stake for the question. They will be withdrawn from your endowment.

- If the correct answer does belong to the interval chosen, the narrower the interval you chose, the more ECUs you will keep. Your payoffs will depend on the difference between the length of the interval chosen and the length of the interval of reference given the following formula:

$$\text{payment} = \begin{cases} -100 * \frac{\text{width of the interval provided}}{\text{width of the interval of reference}} & \text{if the correct answer belongs to the interval provided} \\ -100 & \text{otherwise} \end{cases}$$

In consequence, the wider the interval chosen, the more chances for the correct answer to belong to your interval but the fewer the ECUs you will get to keep if

your interval contains the correct answer.

Symmetrically, the narrower the interval chosen, the less chances for the correct answer to belong to your interval but the more ECUs you will get to keep if your interval contains the correct answer.

After each question, you will see the correct answer, the intervals chosen for the same question by the subjects present in the lab (ranked from the narrower to the wider) as well as the number of ECUs they kept.

Example: For the question, "How old was John Fitzgerald Kennedy when he died?", if the interval of reference is [30;80]:

- If you give the interval [49;54], your potential loss is 10: if the correct answer belongs to the interval [49;54], you will keep 90 ECUs out of the 100 ECUs at stake for this question. Here, your actual loss would be 100 ECUs as the correct answer, 46, does not belong to your interval. Hence, you would have lost the 100 ECUs at stake for this question.

- If you give the interval [40;65], your potential loss is 50 and it corresponds to your actual loss as the correct answer belongs to your interval. In this case, you would have kept 50 ECUs out of the 100 ECUs at stake for this question.

Second step

In this second step, you will also be compensated but you will only be informed of the details of the remuneration afterwards. You will have to answer to a set of 10 questions by providing your best estimate of the answer and confidence intervals, ie

a lower and an upper bound corresponding to a certain level of confidence that the correct answer falls between these 2 values, knowing that:

- The narrower the interval you will provide, the more chances for the correct answer to fall outside.
- The wider the interval you will provide, the more chances for the correct answer to fall inside.

For each question, you will have to give intervals corresponding to 3 different levels of confidence (10%, 50% and 90%). To help you calibrate the risk, here are 3 different and equivalent ways to understand what a 10% interval is:
A 10% interval corresponds to a lower and an upper values such that:

i. You are 10% confident that the correct answer lies between these 2 values.

ii. For 10 questions, 1 correct answer on average belongs to the interval provided and 9 correct answers out of 10 on average fall outside of their interval.

iii. You think there are 9 chances out of 10 for the correct answer to fall outside your interval.

Example of question: What was the year of Vincent Auriol's election as President?
If you give the value 1927 as your best estimation of the answer and the intervals [1921,1930] at 10%, [1915,1935] at 50% and [1915,1949] at 90%, it means that:

- Your best estimate of the year Vincent Auriol was elected is 1927.

- You are 10% confident he was elected between 1921 and 1930.
- You think there is 1 chance out of 2 that he was elected before 1915 or after 1935.
- You are 90% sure that his election happened between 1915 and 1949.

Considering the 10 questions you just answered, please evaluate:

- The number of correct answers falling inside the 10% intervals you provided (please enter a number between 0 and 10).
- The number of correct answers falling inside the 50% intervals you provided (please enter a number between 0 and 10).
- The number of correct answers falling inside the 90% intervals you provided (please enter a number between 0 and 10).

As well as:

- The number of correct answers falling inside the 10% intervals provided by the average subject (please enter a number between 0 and 10).
- The number of correct answers falling inside the 50% intervals provided by the average subject (please enter a number between 0 and 10).
- The number of correct answers falling inside the 90% intervals provided by the average subject (please enter a number between 0 and 10).

For each correct evaluation, you will earn 100 ECUs.

Finally, you will have to make 2 choices each time between 2 bets. For each of these 2 choices, you will earn 300 ECUs if what you bet on happens.

You are finally asked to make two choices between two bets.

- Firsly, you have to choose between betting that at least one correct answer out of ten fell outside of the 90% intervals you provided and betting that at least one correct answer fell inside the 10% intervals you provided.
- Secondly, choose between betting that, out of three questions randomly drawn from the ten questions, at least one correct answer belonged to the 50% intervals you provided and betting that the correct answer to a randomly chosen question belonged to the 90% interval you provided.

For each successful bet you will earn 300 extra ECUs.

Control group

You are about to participate to an experiment aiming at evaluating your ability to calibrate risk.

You will be compensated but you will only be informed of the details of the remuneration afterwards. You will have to answer to a set of 10 questions by providing your best estimate of the answer and confidence intervals, ie a lower and an upper bound corresponding to a certain level of confidence that the correct answer falls between these 2 values, knowing that:

- The narrower the interval you will provide, the more chances for the correct answer to fall outside.

- The wider the interval you will provide, the more chances for the correct answer to fall inside.

For each question, you will have to give intervals corresponding to 3 different levels of confidence (10%, 50% and 90%). To help you calibrate the risk, here are 3 different and equivalent ways to understand what a 10% interval is:
A 10% interval corresponds to a lower and an upper values such that:

i. You are 10% confident that the correct answer lies between these 2 values.

ii. For 10 questions, 1 correct answer on average belongs to the interval provided and 9 correct answers out of 10 on average fall outside of their interval.

iii. You think there are 9 chances out of 10 for the correct answer to fall outside your interval.

Example of question: What was the year of Vincent Auriol's election as President?
If you give the value 1927 as your best estimation of the answer and the intervals [1921,1930] at 10%, [1915,1935] at 50% and [1915,1949] at 90%, it means that:

- Your best estimate of the year Vincent Auriol was elected is 1927.
- You are 10% confident he was elected between 1921 and 1930.
- You think there is 1 chance out of 2 that he was elected before 1915 or after 1935.
- You are 90% sure that his election happened between 1915 and 1949.

Considering the 10 questions you just answered, please evaluate:

- The number of correct answers falling inside the 10% intervals you provided (please enter a number between 0 and 10).
- The number of correct answers falling inside the 50% intervals you provided (please enter a number between 0 and 10).
- The number of correct answers falling inside the 90% intervals you provided (please enter a number between 0 and 10).

As well as:

- The number of correct answers falling inside the 10% intervals provided by the average subject (please enter a number between 0 and 10).
- The number of correct answers falling inside the 50% intervals provided by the average subject (please enter a number between 0 and 10).
- The number of correct answers falling inside the 90% intervals provided by the average subject (please enter a number between 0 and 10).

For each correct evaluation, you will earn 100 ECUs.

You are finally asked to make two choices between two bets.

- Firsly, you have to choose between betting that at least one correct answer out of ten fell outside of the 90% intervals you provided and betting that at least one correct answer fell inside the 10% intervals you provided.
- Secondly, choose between betting that, out of three questions randomly drawn from the ten questions, at least one correct answer belonged to the 50% intervals you provided and betting that the correct answer to a randomly chosen question belonged to the 90% interval you provided.

For each successful bet you will earn 300 extra ECUs.

Questions

Questions of the Training Session:

i. How long, in months, does the gestation of an asian elephant last? (22)
[2,50]

ii. What is the diameter of the Moon in kilometers? (3476)
[10,150000]

iii. What is the distance (in Kilometers) between London and Tokyo? (9559)
[300,40000]

iv. What is the depth of the deepest point in the ocean? (11033)
[10,65000]

v. What was the age at death of Einstein? (76)

[10,100]

vi. How many countries are members of NATO? (26)

[2,200]

vii. What is the number (in millions) of inhabitants of Norway? (4,6)

[0.5,150]

viii. In which year was Mozart born? (1756)

[1300,1980]

ix. How high (in meters) is the Eiffel tower? (324)

[2,4000]

x. How high (in meters) is Mount Blanc? (4808)

[1000,10000]

xi. How much (in euros) does the school education until high school graduation (without repeating) of a student cost? (87730)

[500,300000]

xii. What is the gross monthly income of the french Prime Minister? (20206)

[1000,80000]

xiii. What is the percentage of french households accountable for the "Impôt sur la Fortune"? (1.7%)

[0%,30%]

xiv. What is the french poverty line (monthly euro amount such that anyone earning less is considered poor)? (645)

[30,1500]

xv. What was the unemployment rate in France for the first trimester of 2007? (8.7%)

[0%,40%]

xvi. What is the after-tax monthly income of a CAPES-holder teacher who has been teaching for 10 years? (1859)

[600,10000]

xvii. How much is the "Revenu Minimum d'Insertion" (Minimum insertion outcome) for a single person with no child? (440.86)

[30,1500]

xviii. What is the after-tax monthly income of a beginning university lecturer and researcher? (1655)

[600,10000]

xix. What is the after-tax monthly income of a beginning police officer? (1235)

[600,10000]

xx. What was the per inhabitant GDP in 2004 in France? (26788)

[100,500000]

Questions of the Calibration Task:

i. What was the age at death of Martin Luther King? (39)

ii. How many countries are members of OPEC (Organization of the Petroleum Exporting Countries)? (11)

iii. What is the maximal length in meters of a whale? (33)

iv. What was the year of Ariane rocket's first launch? (1979)

v. What was the year of JS Bach's birth? (1685)

vi. What is the average after-tax monthly income in France? (1903)

vii. What was the unemployment rate in France in 1970? (2.5%)

viii. What percentage of the GDP do the taxes and social security contributions represent? (45%)

ix. What is the after-tax monthly income of a french congressman? (5177.66)

x. What is the average annual cost for the school system of the education of a high-school student? (10000)

Chapter 2

Men too sometimes shy away from competition: The case of team competition

2.1. Introduction

The existence of a gender gap in income and social positions in the American and European labor markets is a well known and well documented fact. [1] The wage gap increases for highly educated workers as one moves up the distribution, as shown by De la Rica *et al.* (2008). Using a sample composed of a large group of US firms, Bertrand & Hallock (2001) found that only 2.5% of the executives in their sample were women. Such a well documented fact has received various explanations [2]

1. See Anker (1998) among the numerous references on the subject
2. See for example Goldin & Rouse (2000), Altonji & Blank (1999)

This chapter tackles one particular explanation for the gender gap: a difference between genders in the taste for performing in competitive environments. For instance, Fox & Lawless (2004) showed that women who share the same personal characteristics and professional qualifications as men express significantly lower levels of political ambition to hold elective office.

Experimental economics has proved to be a useful tool for studying gender differences in the propensity to enter competitive environments, as it enables one to study the competitive behavior of participants in a real-effort exercise while carefully controlling for potential explanations. The core idea is to compare subjects' choices between a remuneration scheme which does not imply competition, i.e. a piece rate, and one that does, i.e. a tournament. Variations in the protocol are used to disentangle the respective explanatory power of alternative explanations. Participants thus have to make successive choices in slightly different environments. An important contribution along this line is Niederle & Vesterlund (2007). Their main result is that women choose to enter the tournament far less often than men, resulting in a male-dominated pool of entrants. [3] More precisely, low-performing men enter the tournament too often while high-performing women do not enter enough, when taking payoff-maximizing choices into consideration. These results show that a substantial gap remains after adding controls for all expected effects such as overconfidence and risk and ambiguity aversion. This residual gap is labeled as a difference

3. See *"Do Women Shy Away From Competition? Do Men Compete Too Much?"* (Niederle & Vesterlund, 2007), *"Male and Female Competitive Behavior: Experimental Evidence"* (Gupta *et al.*, 2005) and *"How Costly is Diversity? Affirmative Action in Light of Gender Differences in Competitiveness"* (Niederle *et al.*, 2008)

between genders in the taste for performing under the pressure of competition. It is worth wondering whether men are more competitive than women per se or if what was thought of as being a gender gap in the taste for competition actually conceals other explanations. For instance, men's greater taste for competition may depend on the type of competition.

The results of Niederle & Vesterlund (2007) raise two concerns. Firstly, reducing the gender gap in social positions is socially desirable. Secondly, from a welfare perspective, competitive environments do not succeed in attracting the best performers. It would therefore be advisable to urge highly able women to enter competitions more often while discouraging men of low ability to do so.

This chapter explores the team competition as a way of reducing the gender gap in tournament entry and getting the best performers to self-select into the competition. Indeed, when they have the option, people often choose to engage in competition with a colleague rather than alone. One can think for instance of academic publication where papers are often co-authored or of invitations to tender which frequently oppose several teams, each representing a firm. Numerous experimental results suggest that the decision-making process may be more efficient among teams than for individuals: teams are faster learners than individuals (Cooper & Kagel, 2005, Kocher & Sutter, 2005), they take more risks when it enables them to get higher expected earnings (Rockenbach *et al.*, 2007) and they play closer to the predictions of game theory (Luhan *et al.*, 2009, Bornstein & Yaniv, 1998). However, as other experimental results point towards less efficiency of groups in comparison

with individuals (Cason & Mui, 1997, Cox & Hayne, 2006), it is not straightforward to predict how the team membership will affect subjects' willingness to compete. One of the main question is whether the team tournament will do a better job of attracting the best candidates into the competition than the individual tournament.

There are several canals through which the competition being team-based rather than individual may affect differently men and women's competitive behavior. Men and women's confidence in their chances of winning the tournament as well as their risk and ambiguity aversion might be affected in a different way. Men and women may also react differently to the fact that, when belonging to a team, one's payoffs are influenced by one's teammate's performance and one's performance influences one's teammate's payoffs. Finally, men and women may experience modifications in their taste for competition (for instance, women may come to like competition more as part of a team or men may not enjoy it as much).

The notion of team used in the present chapter is the most simple one so as not add more complexity: a team is composed of two teammates who perform separately without knowing the identity of their teammate. Being part of a team to compete may have an effect on one's willingness to enter the competition. This intuition is supported by a growing literature in experimental economics which shows that group membership greatly affects individual behaviors. Chen & Li (2009) show that their participants behave more altruistically with an ingroup match than with an outgroup. Charness *et al.* (2007) show that when group membership is made salient, either by common payoffs or by letting an audience of group members watch the

decision-maker, decisions tend to favor more the payoffs of the whole group and Sutter (2009) finds that, in an investment experiment, the decisions made individually by one group member are very similar to the decisions taken jointly by all the members of a team.

The present experiment may add to the findings on group membership, as participants have to decide whether or not to become a member of a team in order to enter a tournament. Comparing the effort of participants who could choose whether to be part of a team to that of participants who were forced to belong to a team, Keser & Montmarquette (2007) found that voluntary teaming significantly increases the level of effort. Having the option to be part of a team may well also have an effect on subjects' competitiveness.

The main result of this chapter is that no gender gap in entry is observed when the tournament is *team-based*, while the *individual* tournament produces a significant gender gap in line with Niederle & Vesterlund (2007) and Niederle *et al.* (2008), henceforth NV and NSV. Whereas women enter as often alone as when part of a team, men enter significantly less often when part of a team. Changes in overconfidence as well as in risk, ambiguity and feedback aversion and the change in the extent to which men and women like competition all account for part of the disappearance of the gender gap in tournament entry. Nevertheless, they do not explain it all. The residual explanation, once controls for all of these factors have been added, is that men, and more precisely high-performing men, dislike the uncertainty on their teammate's ability more than women.

My results suggest that high-performing men's distaste for the team tournament comes from their not wanting to help a less deserving participant get higher payoffs. At least, high-performing men are reluctant to take the chance of losing the tournament because of a less able teammate. They seem ready to give up some of their earnings to prevent that from happening. Indeed, almost all men with an above median performance chose to enter the *individual tournament* but many of them opted out of the standard *team tournament*. To allow us to find out more clearly what caused the change in competitive behavior when the competition was team-based rather than individual, participants had one more choice to make. They had to choose between a piece rate and a specific kind of team tournament, for which the information that they will be matched with a teammate of a level close to their own is added. When confronted with these to alternatives, most high-performing men were back in the tournament.

Team Tournaments help get a gender-balanced pool of entrants, offering women equal chances of winning the competition. Nevertheless, the tournament being team-based negatively affects the quality of the pool of candidates as high-performing men do not enter the team tournament. Team competition thus does not allow to get the best performers to self-select into the competition. A way of achieving *both* an equal representation of genders among entrants and a good quality of the pool of competitors is to assure participants that they will be matched with someone of about the same ability as their own if they choose to enter the team tournament.

The rest of the chapter is organized as follows. Section 2 presents the experimen-

tal design. The results are given in Section 3. Section 4 studies the consequences on welfare of the type of tournament. Finally, Section 5 provides some concluding remarks.

2.2. Experimental Design

The experimental design builds on that of NV. The basic idea is to have participants choose a remuneration scheme between a piece rate and a tournament before they have to perform the exercise determining their payoffs. The exercise subjects were asked to perform is the same as in NV: additions of five 2-digit numbers. Participants were told that they had to complete eight tasks of which two would be randomly chosen for payment at the end of the experiment. The remuneration schemes available (in particular the tournament being rather individual or team-based) changed between tasks and the switches in the choice to enter the tournament provided information on the reasons behind the competitive behaviors.

Teams are tricky to handle and one had to be as careful as possible not to introduce more complexity than needed in the matching process. Teams are composed of two teammates who will not know whether they are matched with a man or a woman as this may well have an impact on one's decision to enter the team tournament. Therefore, subjects have to choose whether to be paid according to a piece rate or a team tournament in which case they will win their tournament if their teammate and themselves solve more additions than their two randomly chosen opponents.

One major change of the competition being team-based rather than individual

is that, in a team tournament, a subject influences her teammate's payoffs and have her teammate influence her own payoffs. In order to control for this factor on one's decision to enter the team tournament, participants also had to make a choice between a piece rate and a team tournament with a teammate of the same level. In this specific kind of team tournament, a participant knew that if she chose to enter she would be matched with a participant with a past performance close to her own. The switches in competitive behavior arising when the matching process changes provide information about the importance of knowing the level of one's teammate when choosing whether to compete.

This section first presents the different effects which needed to be controlled for before detailing the tasks participants had to go through.

2.2.1. What Needs to be Controlled for

The experimental design needs to allow one to disentangle the role played by several factors in explaining the change in the gender gap in entry when the tournament becomes team-based. In order to avoid making the design even more complicated than it already needs to be, the notion of team I selected is the most simple one: two teammates who would not be aware of the identity of their teammate or of that of their opponents. This way, the effect of the gender of one's teammate or opponents on the decision to enter the tournament does not have to be taken into account. Every potential effect of the team tournament had then to be listed before an appropriate way to control for it was found.

First of all, the tournament being team-based rather than individual changes one's expected payoff from entering the tournament for each level of performance. Nevertheless, as the probability changes in the exact same way for men or women, it is unlikely that this change of probability might cause a reduction in the gender gap in tournament entry.

Secondly, NV and NSV found a significant gender gap in overconfidence. It could be the case that overconfidence about one's team chances of winning the tournament differs from overconfidence about one's chances to win the individual tournament. Tajfel (1970) discovered that groups formed on the basis of almost any distinction are prone to ingroup bias. Within minutes of being divided into groups, people tend to see their own group as superior to other groups. It could be the case that men and women differ in how they are affected by this ingroup bias. Women could for example be more optimistic than men about their teammate's performance.

Thirdly, being part of a team could have a different effect on men's and women's ambiguity, risk or feedback aversion. Teams and individuals do not have the same risk preferences. Shupp & Williams (2007) found that the variance of risk preferences is generally smaller for groups than individuals and the average group is more risk averse than the average individual in high-risk situations, but groups tend to be less risk averse in low-risk situations. Rockenbach *et al.* (2007) showed that compared to individuals, teams accumulate significantly more expected value at a significantly lower total risk. Being part of a team may have a different impact on men's and women's risk preferences. Women could, for example, be less risk averse as part of

a team than alone.

Fourthly, in a team competition one's performance influences one's teammate's payoffs and one's payoffs are influenced by one's teammate's performance. For instance, if my teammate is worse than I am, it will lower both my probability of winning the tournament and my payoff if we do win. Charness & Jackson (2009) explore play between groups where one member of each 2-person group dictates the play of that group and is therefore responsible for the payoff of the other group member. They find that a substantial part of the population plays a less risky strategy when choosing for a group than when playing only for themselves. Again, men and women may react differently to this responsibility issue.

Lastly, the taste for competing might change depending on whether one is part of a team or alone. Niederle & Vesterlund (2007) found that, after controlling for differences in overconfidence, risk, ambiguity and feedback aversion, the gender gap in tournament entry was not entirely accounted for. They label the residual explanation as a gender difference in the taste for performing in a competitive environment. The fact that the tournament is no longer an individual one could have a different impact on men's and women's thrill or fear of competition. Indeed, a literature interested in gender differences in economic decisions (Eckel & Grossman, 1998, 2001, 2008a, Ortmann & Tichy, 1999) finds that women tend to be more socially-oriented and less individually-oriented than men as well as more cooperative and less selfish. If team competition succeeds in wiping out the gender gap in the taste for competition, it could lead to a reconsideration of the idea that men are more competitive

than women per se. The following subsection presents the tasks the participants had to go through and explains how they allow one to control for the effects listed in the present subsection[4].

2.2.2. The Tasks

At the end of each task, participants were informed of their absolute performance (the number of additions they correctly solved) but were not informed of their relative performance until the end of the experiment. Participants received instructions on a task only immediately before completing it.

Task 1. piece rate: Participants are given the three-minute addition exercise. If Task 1 is randomly chosen for payment, they receive 50 cents per correct answer.

Task 2. individual tournament: Participants are given the three-minute addition exercise. If Task 2 is chosen for payment, the subject receives 1 euro per correct answer if she solved more additions than her randomly chosen opponent, otherwise she receives nothing.

Task 3. Choice between piece rate (PR henceforth) and individual tournament (IT henceforth): Before they perform their additions, subjects have to choose whether they want to be paid according to the piece rate (50 cents per correct answer) or the individual tournament compensation scheme. A participant who selects the tournament receives 1 euro per correct answer if her Task 3 performance exceeds the Task 2 performance of a randomly chosen opponent, otherwise she re-

4. See Table 2.9 in Appendix B for a synthesis of tasks and what they control for

ceives nothing. Subjects are competing against a competitive performance of their opponent but the decision to enter the tournament is not affected by beliefs about whether the opponent is going to enter. In addition, it allows one to rule out the possibility that a participant may not enter because she may fear to inflict losses on her opponent.

Task 3 bis. Choice between *submitting* Task 1 performance to piece rate or individual tournament: No additions to do here, the performance which will determine the payoff is the task 1 performance. If a participant chooses to submit her task 1 performance to the piece rate, she receives 50 cents times her Task 1 performance. If she chooses to submit her Task 1 performance to the individual tournament, she receives 1 euro per addition correctly solved in Task 1 if she solved more additions than her randomly chosen opponent, otherwise she receives nothing. Task 3 bis is identical to Task 3 (in both cases the tournament is a more risky choice implying more ambiguity and subjecting the participant to feedback at the end of the experiment concerning whether she beat her opponent) except for the fact that it does not involve a future performance. In particular, the participant who chooses to submit her past performance to the tournament does not have to perform under the pressure of competition. In consequence, any change in behavior between Tasks 3 and 3 bis will be attributed to the taste for performing in a competitive environment.

Task 4. Choice between piece rate and team tournament: Subjects have to choose whether they want to be paid according to the piece rate or the team tournament. The team tournament is a two to two competition. If a participant

chooses the team tournament, two opponents are randomly drawn among the other participants present in the room. One teammate is randomly drawn among the participants who chose the team tournament. [5] This implies that a subject who chooses to enter the team tournament knows that her teammate will have made the same choice so that both teammates will be competing at the same time against their opponents, facilitating the emergence of a team spirit. If the number of additions solved by one's team during Task 4 exceeds the number of additions solved by the opposing team during Task 2, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing.

Task 4 bis. Choice between *submitting* Task 1 performance to piece rate or team tournament: No additions to do here, the performance which will determine the payoff is the Task1 performance. If a participant chooses to submit her Task 1 performance to the piece rate, she receives 50 cents times her Task 1 performance. If she chooses to submit her Task 1 performance to the team tournament, two opponents are randomly drawn among the other participants present in the room. One teammate is randomly drawn among the participants who chose to submit to the team tournament. [5] If the number of additions solved by one's team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing. Task 4 bis is identical to Task 4 (considering over-

5. In the case where only one participant would have chosen the team tournament, which never happened, the teammate would have been drawn among participants who chose the piece rate. Also, if an uneven number of participants chose the team tournament, participants were paired and a teammate was randomly chosen among them whose performance was added to the remaining participant's performance to compute the score of her team.

confidence, risk aversion and uncertainty about teammate's ability) except for the fact that it does not involve a future performance. In particular, the participant who chooses to submit her past performance to the team tournament does not have to perform under the pressure of competition. In consequence, any change in behavior between Tasks 4 and 4 bis will be attributed to the taste for performing in a team competition.

Task 5. Choice between piece rate and team tournament with a teammate of the same level (TTid henceforth): If a participant chooses the team tournament with a teammate of the same level, two opponents are randomly drawn among the other participants present in the room. One teammate is attributed from among the participants who chose the team tournament: the participant whose Task 2 performance was the closest to the participant's own Task 2 performance. If the number of additions solved by one's team during Task 4 exceeds the number of additions solved by the opposing team during Task 2, each teammate receives 1 euro times the average Task 5 score of their team. Task 5 resembles Task 4 in that the subjects have to choose between a piece rate remuneration and a team tournament but in Task 5 the uncertainty about one's teammate's ability at solving additions (or at least part of it) is taken away. Then, assuming that learning effects are the same for men and women, if men's and women's behavior changes in a different way between Task 4 and Task 5, it will be attributed to a different reaction to the uncertainty about one's teammate's ability.

Task 5 bis. Choice between *submitting* Task 1 performance to piece rate

or team tournament with a teammate of the same level: No additions to do here, the performance which will determine the payoff is the Task 1 performance. If a participant chooses to submit her Task 1 performance to the piece rate, she receives 50 cents times her Task 1 performance. If she chooses to submit her Task 1 performance to the TTid, two opponents are randomly drawn from among the other participants present in the room. One teammate is attributed from among the participants who chose the team tournament: the participant whose Task 2 performance was the closest to the participant's own Task 2 performance. If the number of additions solved by one's team during Task 1 exceeds the number of additions solved by the opposing team during Task1, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing.

Belief-assessment Questions

A difference in confidence between men and women may explain a significant part of the gender gap in tournament entry. NV and NSV found that both men and women are overconfident but men are more so. In order to control for differences in confidence both in one's chances of winning the individual tournament and in one's team chances of winning the team tournament, participants had to answer belief-assessment questions at the end of the experiment. Participants had to guess the mean Task 1 and Task 2 performances of the participants in their session.

The participants were recalled that during Task 4 they had to choose between a piece rate and a team tournament, for which two opponents were randomly drawn from among the other participants and a teammate was randomly drawn from among

the other participants who had chosen the team tournament. They were also told that even if they had chosen the piece rate at Task 4, two opponents and One teammate had still been randomly chosen in the exact same way. Their own Task 2 performance was recalled to them and participants had to guess the Task 2 performances of their teammate and opponents chosen during Task 4. The participants were recalled that during Task 4 bis they had to choose between submitting their Task 1 performance to either a piece rate or a team-tournament, for which two opponents were randomly drawn from among the other participants and a teammate was randomly drawn from among the other participants who had chosen to submit to the team tournament. They were also told that even if they had chosen the piece rate at Task 4 bis, two opponents and one teammate had still been randomly chosen in the exact same way. Their own Task 1 performance was recalled to them and participants had to guess the Task 1 performances of their teammate and opponents of Task 4 bis. A participant knew she would earn 1 euro per correct guess.

2.3. Results

The experiment was run at the Parisian Experimental Economics Laboratory (LEEP) of Paris 1 University.[6] 39 men and 37 women took part in the experiment. 68 of those 76 subjects were students, among which 25 were economics majors and 9 were management majors. There were 6 sessions and the proportion of women in these sessions varied between 31% and 71%. The average participant earned

6. Subjects were recruited through the online recruitment system ORSEE (Greiner, 2004). The experiment was computerized using the REGATE software (Zeiliger, 2000).

15,86 euros including a 7-euro show-up fee. This section presents the results of this experiment. It starts by studying the gender differences in performance and entry in the individual tournament, providing results in line with NV. Then the gender differences in entry in the team tournament are explored. Finally, the explanatory power of the different potential explanations for the disappearance of the gender gap in entry is investigated.

2.3.1. Gender Differences in Performance and in Entry in the Individual Tournament

In this subsection, I check whether there are some gender differences in performance, which was the case in NSV but not in NV. I also look at the gender gap in the individual tournament entry. In the present chapter, a participant in the individual tournament is the winner if she beats one opponent. This one-to-one competition could have an effect on the participants' decision to enter. In NV, one has to beat the performances of three other participants to be considered the winner of the tournament. Here, I chose to consider a one-to-one competition as a matter of simplicity since I subsequently needed to introduce teams.

Men's performances were slightly above women's. In Task 1 (piece rate), men solved 5.9 additions on average while women solved 5.6 additions. In Task 2 (tournament), men solved 7.4 additions on average while women solved 6.3 additions. These differences are not significant with a two-sided Mann-Whitney test. While men perform significantly better under the tournament than under the piece rate (a

two-sided Mann-Whitney test yields p=0.04), it is not the case for women (p=0.34). After having gone through the piece rate and tournament remuneration schemes, participants have to choose which one they want to perform under for Task 3. If they choose the tournament, they will be considered the winner if they beat the Task 2 performance of their opponent. Considering the true distribution of Task 2 performances, a payoff-maximizing participant should choose the tournament if her task 3 performance exceeds 6 (see Figure 2.10 in Appendix A: an omniscient participant with a performance above or equal to 6 has higher expected payoffs from the individual tournament than from the piece rate). If the participant's Task 3 performance is exactly the same as her Task 2 performance, 62% of women and 67% of men have higher expected earnings from the tournament. This predicted gender gap is not significant (a two-sided Fisher's exact test yields p=0.81).

As in NV, there is a gender gap in the individual tournament entry: 51.35% of women and 84.62% of men chose to enter the individual tournament. This difference is significant with a two-sided exact Fisher's test (p=0.00). While men enter significantly more often than expected (p=0.00), it is not the case for women (p=0.65). However the gender gap in tournament entry is greater for participants with above median Task 2 performances. 50% of low performing women and 62% of low performing men chose to enter the individual tournament (a two-sided Fisher test yields p=0.70). Among high performing participants, 52% of women and 96% of men entered the tournament (p=0.00). The first logit regression of Table 3.1 shows tournament entry as a function of the participant's gender and Task 2 performance. High performing

Table 2.1: Logit of Tournament-Entry Decision (Task 3)

Regressors	(1)	(2)	(3)
Female	-0.29	-0.25	-0.16
	(0.01)	*(0.01)*	*(0.01)*
Perf2	0.05	0.03	0.01
	(0.04)	*(0.19)*	*(0.49)*
Guesswin		0.40	0.33
		(0.01)	*(0.04)*
Submit			0.15
			(0.01)
Observations	76	76	76

Logit regressions.
The table presents marginal effects computed at a man with a Task 2 performance of 6.86 which corresponds to the average Task 2 performance. P-values are in brackets.

participants tend to enter more often but controlling for performance, women enter significantly less often than men.

This gender-gap in tournament entry has several potential explanations: differences in overconfidence between men and women, differences in risk, ambiguity and feedback aversion, differences in the taste for performing in a competitive environment. We start by examining whether men are more overconfident than women, as found in NV and NSV. At the end of the experiment, participants' Task 2 performance was recalled to them and they had to guess the Task 2 performance of their teammate and opponents at Task 4. From their answer, their guessed rank was computed and the guessed ranks conditional on the actual Task 2 performance (4 levels were assigned, each corresponding to 25% of participants) were compared.

An ordered logit regression of the guessed rank yields a negative and significant ($p<0.01$) coefficient of Task 2 performance and a positive and significant effect of Female ($p=0.07$). The higher the Task 2 performance, the better the participant thinks

she is, while, for a given performance, men are more overconfident than women.

The second regression of Table 3.1 shows that the more confident the participant is about winning (guesswin=1 if the participant's guess of the mean Task 2 performance is below her own Task 2 performance, otherwise guesswin=0), the more prone she is to enter the tournament. Adding this control for this measure of confidence, the gender gap in tournament entry diminishes but remains significant. The difference in confidence between genders accounts for part of the gender gap in tournament entry: the fact that women are less confident than men in their chances of winning the tournament helps explain why they enter the tournament less often. Nevertheless, when controlling for Task 2 performance and beliefs about winning, women still choose to enter less often than men, meaning that the gender gap in entry is not only due to women being less able or less confident than men.

In order to also control for the role of risk, ambiguity and feedback aversion in the gender gap in tournament entry, the Task 3 bis decision to submit the Task 1 performance to either a piece rate or an individual tournament is used. Indeed, the Tasks 3 and 3 bis decisions are the same except for the fact that only in Task 3 does the participant actually have to perform in a competitive environment. In consequence, when adding the Task 3 bis decision in the regressors, any remaining gender gap will be attributed to a difference in the taste for performing under competition since Submit allows to control one more time for one's confidence in her chances to win and adds a new control for risk, ambiguity and feedbck aversion. The third regression of Table 3.1 shows that a participant who chooses to submit her Task 1

performance is more likely to choose to enter the individual tournament but a great and significant gender gap remains. The fact that women are more averse to risk, ambiguity and feedback than men helps explain why they enter the tournament less often since the coefficient of Female diminishes when adding the decision to submit to the regressors. Nevertheless, the residual significant gender gap must be attributed to a difference in the taste for performing in a competitive environment between genders. These results are in line with NV and NSV.

2.3.2. Gender Differences in Entry in the Team Tournament

As for the individual tournament, anyone with higher expected earnings from the team tournament than the piece rate should enter the team tournament. As can be seen in Figure 2.10 of Appendix A, this corresponds to participants with a Task 2 performance above or equal to 6. This is the case for 62% of women and 67% of men. The predicted gender gap is not significant (p=0.81).

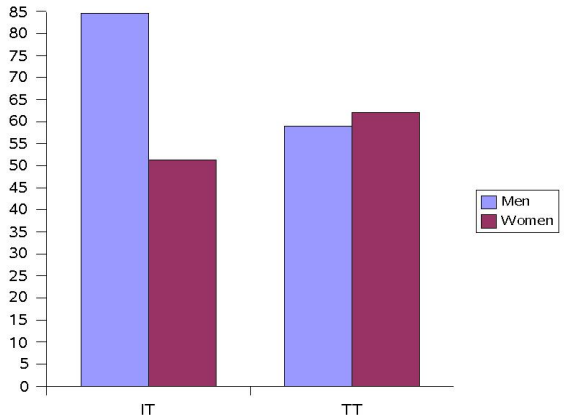

Figure 2.1. Proportion of male and female entrants in the individual tournament (IT) and team tournament (TT).

In line with the predictions, the data do not bring any gender gap to light: 62% of women and 59% of men chose to enter the team tournament (p=0.82). Men enter less than what is predicted by payoff maximizing choices but not significantly less (p=0.49). As can be seen in Figure 2.1, it appears that while women do not choose to enter the tournament significantly more often when it is team-based (p=0.48), men enter significantly less as part of a team than alone (p=0.02).

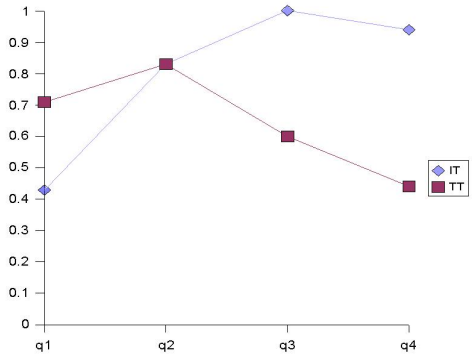

Figure 2.2. Proportion of men entering the individual and Team Tournaments conditional on performance level.

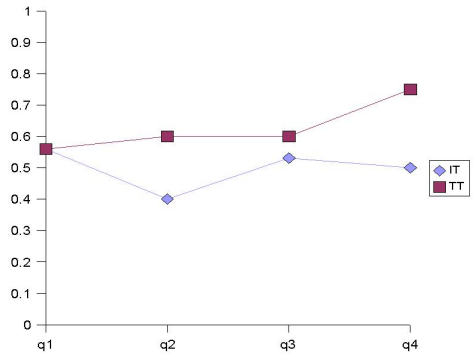

Figure 2.3. Proportion of women entering the individual and Team Tournaments conditional on performance level.

Figures 3.4 and 2.3 show the percentage of men and women who choose to enter the individual and team tournament conditional on their Task 2 performance level. It can be seen that when the tournament is team based, men tend to enter less often for a given probability of winning, while women seem to enter a little bit more. It is also noteworthy that the relation between the performance level and the team tournament entry decision is decreasing for men. The logit regression of men's decision to enter the team tournament on the probability of winning (see Appendix A for an explanation of how the probability of winning was computed) provides a negative but only marginally significant coefficient (p=0.10). The implications of

Table 2.2: Logit of Tournament-Entry Decision (Tasks 3 and 4)

Regressors	Men	Women	All
Female			-0.21
			(0.00)
Female*Team			0.15
			(0.01)
Team	-0.26	0.11	-0.15
	(0.01)	*(0.32)*	*(0.01)*
Prob	0.16	0.12	0.14
	(0.45)	*(0.67)*	*(0.41)*
Observations	78	74	152

Logit regressions using clusters for each participant.
The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament. P-values are in brackets.

the tournament being team-based rather than individual on the pool of entrants will be discussed in Section 4.

A logit regression of the decision to enter a tournament (Task 3 and Task 4) on the probability of winning (Prob) and a team dummy (team=1 for the Task 4 decision to enter the team tournament and team=0 for the Task 3 decision to enter the individual tournament) is reported in Table 2.2. Even though the probability of winning is unknown to the participant, including it to the regressors allows one to compare the efficiency of the different tournaments (Does a given tournament leads the better participants to self-select into it?). As two observations were used for each participant (Task 3 and Task 4 decisions to enter each of the tournaments), a cluster on the participant was used to take into account the fact that the two decisions to enter the tournaments taken by the same individual are not independent. Conditional on the probability of winning, the fact that the tournament is team-based decreases men's propensity to enter while it has no significant effect on women's de-

cision to enter. The probability of winning has no significant effect on either men's or women's propensity to enter. Overall, participants tend to choose less often to enter the tournament when it is team-based. The positive and strongly significant marginal effect of Female*Team shows that when the tournament is team-based the gender gap in tournament entry is significantly reduced.

2.3.3. Explanations for the Changes in Tournament Entry Between the Individual Tournament and the Team Tournament

The change in the probability of winning does not provide an explanation for the reduction of the gender gap in tournament entry which arises between the individual and the team tournament, as both men and women endure the same distortion of the probability of winning. In this subsection, the roles of the other potential explanations cited in the introduction are investigated.

2.3.3.1. The Role of Beliefs

Confidence in subjects' chances of winning the individual tournament helped explain their decision to enter the individual tournament. In the individual tournament, men were found to be more overconfident in their chances of winning than women. It would be interesting to see whether this is also the case for the team tournament or if the gender difference in overconfidence is reversed when participants are part of a team. For instance, women could feel more confident about their chances of winning when they are paired with a teammate because they could

be more optimistic than men about the performance of their teammate. In such a case, this change in beliefs would help explain the reduction of the gender gap in tournament entry. To assess for the potential explanatory power of beliefs on the disappearance of the gender gap in entry in the team tournament, we use the dummy Guesswin which equals 1 if the participant's beliefs are consistent with winning the tournament, and 0 otherwise. Remember that a participant knows her absolute performance at each task. For the individual tournament, Guesswin equals 1 if the participant thinks her Task 2 performance is above average and 0 otherwise. For the team tournament, Guesswin equals 1 if the participant thinks the sum of her Task 2 performance and her teammate's Task 2 performance exceeds the sum of their opponents'Task 2 performances.

Table 2.3: Logit of Tournament-Entry Decision (Tasks 3 and 4)

Regressors	Men	Women	All
Female			-0.17
			(0.00)
Female*Team			0.13
			(0.01)
Team	-0.20	0.14	-0.11
	(0.02)	*(0.29)*	*(0.01)*
Prob	-0.17	0.03	-0.03
	(0.45)	*(0.92)*	*(0.86)*
Guesswin	0.39	0.16	0.23
	(0.01)	*(0.33)*	*(0.03)*
Observations	78	74	152

Logit regressions using clusters for each participant.
The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament and with beliefs consistent with winning the tournament. p-values are in brackets.

The first regression reported in Table 2.3 shows that beliefs help explain men's decision to enter the tournaments. Controlling for beliefs, the coefficient of Team in

men's regression is reduced showing that part of the explanation why men enter less often in the tournament when it is team-based comes from men being less confident in their chances of winning the tournament as part of a team than alone. However, since Team remains negative and significant, it must be that other factors account for men's disaffection for the tournament when it is team-based. On the other hand, beliefs are not helpful in explaining women's decision to enter.

Overall, a participant whose beliefs are consistent with winning the tournament is 23% more likely to enter than a similar participant whose beliefs are consistent with losing the tournament. Controlling for beliefs, the effect of Female*Team decreases but remains positive and significant. The reduction of the gender gap in overconfidence which occurs when the tournament becomes team-based helps explain the disappearance of the gender gap in tournament entry, but other factors must play a role as this change in beliefs does not explain all of it.

2.3.3.2. The Role of the Taste for Competition.

A second factor which is likely to explain part of the disappearance of the gender gap when the tournament is team-based is the taste for competition which may be different when the type of competition changes. To control for this, the decisions to submit the Task 1 performance to the individual and team tournament are used. Indeed, the decisions to enter a given tournament and to submit a past performance to the same tournament are very similar in every aspect, except for the fact that only when deciding to enter a tournament does the participant actually have to perform

in a competitive environment. Consequently, by adding the decision to submit, one can see whether the disappearance of the gender gap occurring when the tournament is team-based is fully accounted for by changes in confidence, risk, ambiguity and feedback aversion and the reaction to the uncertainty on one's teammate's ability or if part of it is due to changes in how men and women like to perform in a competitive environment.

Table 2.4: Logit of submitting a past performance to a tournament (Tasks 3 bis and 4 bis)

Regressors	Men	Women	All
Female			0.00
			(0.48)
Female*Team			0.09
			(0.19)
Team	0.00	0.20	0.07
	(0.84)	*(0.16)*	*(0.87)*
Prob	-0.09	0.57	0.24
	(0.76)	*(0.12)*	*(0.25)*
Guesswin	0.27	-0.05	0.06
	(0.07)	*(0.75)*	*(0.47)*
Observations	78	74	152

Logit regressions using clusters for each participant.
The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament and with beliefs consistent with winning the tournament. p-values are in brackets.

Table 2.4 presents the logit regression of the decision to submit Task 1 performance to the tournament. Decisions to submit both to the individual and to the Team Tournaments are used. It can be seen that neither for men nor for women is the coefficient of Team significant, showing that the fact that the tournament is team-based rather than individual does not influence the decision to submit to a tournament. In particular, men are not less likely to submit a past performance to a tournament when it is team-based, while they choose to enter a tournament sig-

nificantly less as part of a team than alone. In the pooled regression, Female*Team is not significant, showing that the fact that the tournament is team-based does not help reduce the gender-gap in submission to the tournament. It must be that changes in men and women's taste for competition must play a role in explaining the disppearance of the gender gap when the tournament is team-based.

In the logit regressions presented in Table 2.5 the decision to submit Task 1 performance was added to the regressors to explain the decision to enter the tournament. For both men and women, the decision to submit to the tournament helps explain the decision to enter the tournament. Such is also the case in the pooled regression where it can be seen that compared with someone who decided not to submit, an otherwise similar participant who did submit has a 27% higher chance of entering the tournament.

Table 2.5: Logit of Tournament-Entry Decision (Tasks 3 and 4)

Regressors	Men	Women	All
Female			-0.09
			(0.00)
Female*Team			0.06
			(0.02)
Team	-0.11	0.12	-0.05
	(0.00)	*(0.60)*	*(0.00)*
Prob	-0.06	-0.17	-0.12
	(0.77)	*(0.48)*	*(0.40)*
Guesswin	0.21	0.17	0.17
	(0.02)	*(0.22)*	*(0.01)*
Submit	0.25	0.27	0.27
	(0.00)	*(0.00)*	*(0.00)*
Observations	78	74	152

Logit regressions using clusters for each participant.
The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament, with beliefs consistent with winning the tournament and who submitted his Task 1 performance to the tournament. P-values are in brackets.

When adding this new control, men still react negatively to the fact that the tournament is team-based but less so. This suggests that changes in men's confidence and risk, ambiguity and feedback aversion as well as their reaction to the uncertainty on their teammate's ability help explain why they do not enter the team tournament as often as they did the individual tournament. Indeed, adding the decision to submit to the regressors allows to control for every factor that may affect the decision to enter a tournament except for a change in the taste for competition. The fact that the coefficient of Team becomes less negative in men's regression therefore indicates that, when the tournament is team-based rather than individual, the fact that men are less confident, more risk, ambiguity and feedback averse and/or react negatively to their not knowing the ability of their teammate help explain the elimination of the gender gap in tournament entry. Nevertheless, as the coefficient of Team remains negative and significant, another factor must play a role in men's disaffection for the team tournament: men do not enjoy performing in a competitive environment as much when it is a team competition.

As for women, the coefficient of Team has decreased but remains positive and significant showing that women must experience more confidence, less risk, ambiguity and feedback aversion in the team tournament than in the individual tournament and/or they enjoy not knowing the level of their teammate, but it is not enough to explain all of their extra attraction to competition when it is team-based which is partly due to the fact that they come to like competition more when they are part of a team.

In the pooled regression the coefficient of Female*Team is largely reduced when the decision to submit is added to the regressors, but it remains positive and significant. Part of the disappearance of the gender gap in tournament entry is due to a reduction in the gender difference in confidence, risk attitude and to the fact that men dislike ignoring the ability of their teammate more than women. Nevertheless, a part of this disappearance remains unexplained which is accounted for by a reduction of the gender gap in the taste for competition.

2.3.3.3. The Role of Uncertainty About One's Teammate's Ability.

The effect of one last factor cited has to be controlled for: the taste for influencing one's teammate's payoffs and for having one's teammate influence one's own payoffs.

In order to do so, the Task 5 decision to enter the team tournament with a teammate of the same level (TTid) is used in addition to the Task 3 and 4 decisions. The Task 5 decision resembles the Task 4 decision (team tournament) except for the fact that the uncertainty about the level of one's teammate in the addition addition (or at least part of it) is removed, since the participant knows that if she enters the tournament she will be matched with a teammate whose Task 2 performance is close to her own. Consider a participant who chooses not to enter the Task 4 team tournament but does enter the Task 5 team tournament with a teammate of the same level. One will be able to infer that the reason why this participant does not like the Task 4 team tournament is because of the uncertainty surrounding her teammate's level [7].

7. Obviously, since Task 5 is completed after Task 4, order effects can play a role, but it seems reasonable

In the regressions presented in Table 2.6 the dummy IdPartn equals 1 when the tournament proposed is a team tournament with a teammate of the same level (Task 5) and 0 otherwise.

Table 2.6: Logit of Tournament-Entry Decision (Tasks 3, 4 and 5)

Regressors	Men	Women	All
Female			-0.05
			(0.00)
Female*Team			0.04
			(0.01)
Team	-0.07	0.15	-0.01
	(0.00)	*(0.68)*	*(0.00)*
Prob	0.07	-0.22	-0.04
	(0.60)	*(0.24)*	*(0.71)*
Guesswin	0.24	0.22	0.21
	(0.01)	*(0.06)*	*(0.00)*
Submit	0.29	0.36	0.35
	(0.00)	*(0.00)*	*(0.00)*
IdPartn	0.06	0.08	0.17
	(0.15)	*(0.35)*	*(0.07)*

The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament, with beliefs consistent with winning the tournament and who submitted her Task1 performance to the tournament. p-values are in brackets.

The fact that a participant knows that her teammate will be of a similar level to her own if she chooses to enter the tournament makes it more likely for her to choose to enter since the coefficient of IdPartn is positive and signifcicant in the pooled regression. The introduction of IdPartn in the regressors makes the coefficient of Team less negative in men's regression, suggesting that men's distaste for the uncertainty about their teammate's ability is not enough to explain why their taste for competition decreases when it is team-based. However, as Team remains negative and significant, it must be that the uncertainty about their teammate's

to assume these order effects would be the same for men and women.

ability does help explain why men are less drawn to the team tournament than they are to the individual tournament. As for women, as the coefficient of Team increases when IdPartn is added to the regressors, it seems that the tournament being team-based makes them like competition more.

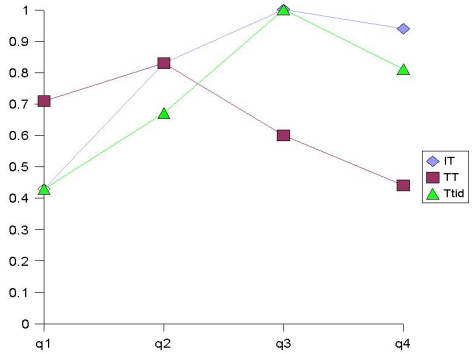

Figure 2.4. Proportion of men entering the tournaments conditional on performance level.

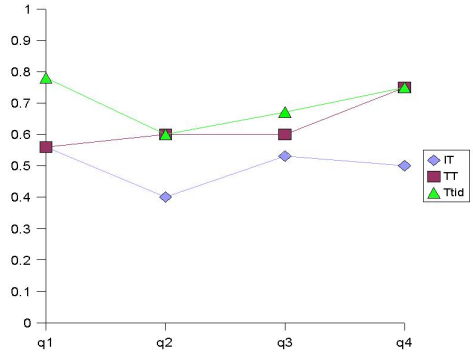

Figure 2.5. Proportion of women entering the tournaments conditional on performance level.

In the pooled regression, the introduction of IdPartn reduces the coefficient on Female*Team by one third. It must therefore be that part of the disappearance of the gender gap which occurs when the tournament becomes team-based is due to the fact that when the tournament is team-based a change occurs in how men and women like to perform in a competitive environment, probably in the sense of men not liking to perform in a competitive environment as much when part of a team. Nevertheless, as the coefficient on Female*Team is equal to two thirds of its previous value and remains significant, part of the disappearance of the gender gap is not accounted for by a different impact of the tournament being team-based on men and women's taste for evolving in a competitive environment, but must be attributed to the fact that men do not like the uncertainty about their teammate's

level when having to perform in a team competition.

Looking more closely at which men and women self-select into the different kinds of tournaments, it seems that it is mainly high-performing men who run away from the team tournament when they do not know the level of their teammate. Indeed, Figures 2.4 and 2.5, show that high-performing men choose massively to enter the individual tournament (96% of above median male performers enter the individual tournament) and the team tournament with a teammate of the same level (88%) but a lot of them choose the piece rate when proposed a standard team tournament (50%). As for women, they seem to enter a little bit more whatever their performance level when the tournament is team-based. Furthermore, whether they know something about the ability of their teammate does not much change their propensity to enter.

In order to confirm this intuition, I ran a logit regression presented in Table 2.7 adding the interaction term Prob*Team.

The results of the regressions of Table 2.7 suggest that the disaffection of men for the team tournament is widely caused by high-performing men. Indeed, in men's regression, the coefficient of Team is no longer significant once Prob*Team is added to the regressors. It indicates that high-performing men would rather lose part of their payoffs by choosing the piece rate than take the chance of maybe helping a less deserving participant get higher payoffs by entering the team tournament. In the pooled regression, the coefficient of Female*Team is reduced by one quarter, indicating that the reduction of the gender gap in tournament entry when the tournament

Table 2.7: Logit of Tournament-Entry Decision (Tasks 3, 4 and 5)

Regressors	Men	Women	All
Female			-0.04
			(0.00)
Female*Team			0.03
			(0.01)
Team	0.05	0.05	0.07
	(0.87)	*(0.88)*	*(0.21)*
Prob	0.48	-0.24	0.06
	(0.15)	*(0.40)*	*(0.74)*
Guesswin	0.27	0.21	0.24
	(0.00)	*(0.06)*	*(0.00)*
Submit	0.28	0.37	0.33
	(0.00)	*(0.00)*	*(0.00)*
IdPartn	0.06	0.08	0.08
	(0.17)	*(0.36)*	*(0.08)*
Prob*Team	-0.53	0.03	-0.16
	(0.13)	*(0.91)*	*(0.41)*

The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament, with beliefs consistent with winning the tournament and who submitted his Task 1 performance to the tournament. P-values are in brackets.

is team-based rather than individual is mainly attributable to high-performing men. This result is in line with Durante & Putterman (2008) who found that men, but not women, choose significantly lower taxation rates when pre-tax incomes are determined on the basis of performance in a game rather than randomly. Men seem unwilling to lower their payoffs in order to increase those of a less able participant who they see as being less deserving.

2.4. Consequences on Efficiency of the Type of Competition.

The introduction of the team tournament was successful in wiping out the gender gap in tournament entry. It is obviously essential to closely study the consequences of the team tournament on other aspects in order to weigh up the pros and cons. This

section studies the consequences of the type of tournament on participants' payoffs as well as on the pool of entrants and its quality, i.e. the performance of those who choose to enter. It enables one to draw some conclusions on the implications of the choice of a type of competition for both contestants and recruiters.

A question crucial to our interest is how the type of tournament influences the quality of the pool of entrants. Figure 2.6 represents the percentage of participants who chose to enter each of the three tournaments conditional on Task 2 performance level. Compared with the individual tournament, more low-performing and fewer high-performing participants choose to enter the team tournament. This obviously affects the average performance of the entrants, even though the difference in performance between the entrants of the individual and team tournament is not significant (p=0.18 for the two-sided Mann Whitney test and p=0.09 for the one-sided test). On the other hand, the proportion of entrants of each performance level in the TTid is similar to the proportion of entrants in the individual tournament.

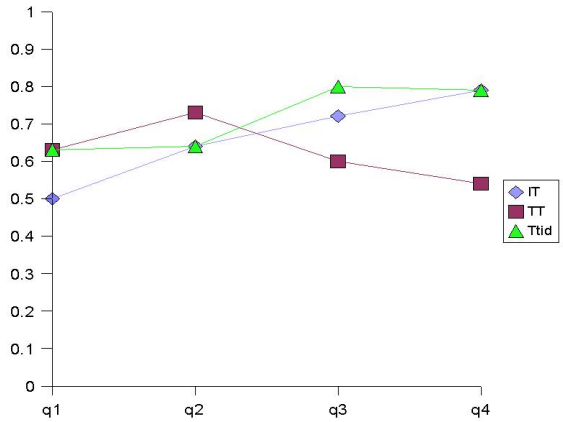

Figure 2.6. Proportion of entrants in the tournaments conditional on performance level.

Figures 2.7 and 2.8 show respectively the average performances and payoffs of

male and female entrants in the three kinds of tournament. Men's performances are slightly higher than women's (except for the team tournament where male and female entrants are of the same level) but not significantly so. We can observe a decrease of men's performance when the tournament becomes team-based which is, however, not significant. It may be due to men shirking when part of a team, but it may also be caused by the selection effect (numerous high-performing men opt out of the team tournament while they entered the individual tournament). Female entrants' performance, on the other hand, is very stable across tournaments. In consequence, the fact that the tournament is team-based does not negatively affect the quality of the female pool of entrants. Still, the average performance of entrants is lower under the team tournament (6.48) than under the individual tournament (7.48). Men's performance goes up again when participants know that they will be matched with a teammate of the same level.

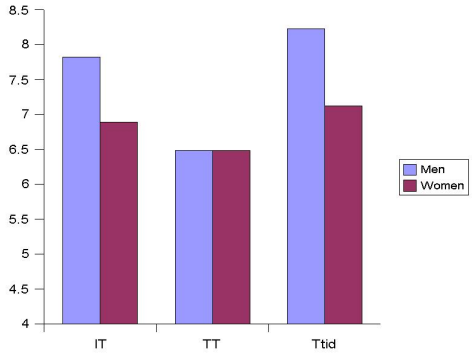

Figure 2.7. Performance (number of additions correctly solved) of male and female entrants in the three tournaments.

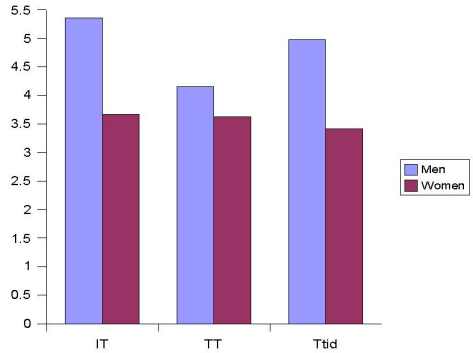

Figure 2.8. Payoffs (in euros) of men and women for the three tournaments.

In order to check whether male entrants' average performance is lower under the team tournament than under the individual tournament because of shirking

behaviors or because of a selection bias, I ran a Heckman's two-step estimation. I first look at what determines the decision to enter the tournament using a Probit model. Then, conditional on that decision, the (task 2) performance is explained with an OLS model corrected for the selection bias. The results of the first regressions were already discussed earlier. The secong regression of table 2.8 suggests that participants do not lower their effort when engaged in the team tournament. Indeed, there is no significant drop in performance of candidates to the team tournament in comparison with candidates to the individual tournament. I can therefore rule out shirking as an explanation for the decrease in performance of male entrants between the individual and the team tournament. The remaining explanation is the selection effect due to high-performing men shying away from the tournament when it is team-based and they do not know anything about their teammate's ability. The fact that the inverse mill's ratio (Lambda) is highly significant shows that controlling for the selection bias was necessary.

As for payoffs, the gender payoff gap is marginally significant for the individual tournament and the team tournament with a teammate of the same level (p=0.11 each time with a two-sided Mann-Whitney test) but it is far from being significant (p=0.33) for the team tournament. The disappearance of the gender gap in payoffs occuring in the team tournament comes nevertheless with a cost, as men undergo a decrease in their payoffs while women's payoffs remain stable (due to high-performing men not entering the tournament when it is team-based). It is then worth wondering whether this dumbing down of payoffs is too high a price for gender equality. Notice

Table 2.8: Heckman two-step regression model with sample selection for dependent variable Perf2 (task 2 performance)

	Regressors	Coefficient	p-value
Tournament-entry decision			
	Intercept	0.46	0.15
	Female	-1.01	0.00
	Team	-0.84	0.01
	Female*Team	1.17	0.01
	Guesswin2	0.74	0.00
Observations		152	
Perf2			
	Intercept	9.25	0.00
	Female	1.63	0.21
	Team	1.26	0.27
	Female*Team	-2.31	0.15
	Lambda (IMR)	-5.8	0.00
Observations		98	

that providing information about one's teammate's ability is enough to see men's payoffs go up again, increasing in turn the gender payoff gap.

To sum up, the team tournament allows to obtain a gender-balanced pool of entrants and to eliminate the gender payoff gap. However, this comes at the cost of a deteriorated average performance of entrants. Under the team tournament with a teammate of the seme level, performances of both male and female contestants are at their highest levels as can be seen from Figure 2.7. Since, furthermore, men and women enter at similar rates (p=0.52) in this tournament, it seems to offer several attractive features.

2.5. Conclusion

This chapter aims at studying the effect of a tournament being team-based rather than individual on the gender gap in tournament entry. The results allow a better understanding of the gender gap in competitiveness and provide a way of obtaining a gender-balanced pool of entrants. While a large and significant gender gap in entry in the individual tournament is found in line with NV and NSV, no gender gap is found in entry in the team tournament. Women do not choose to enter the tournament significantly more often when it is team-based but men enter significantly less as part of a team than alone. A first explanation is a reduction of the gender gap in overconfidence occurring when subjects are part of a team (men are less overconfident when part of a team than alone). Another explanation lies in a change in risk, ambiguity and feedback aversion: women become less risk, ambiguity and feedback averse when part of a team than alone and men become more risk, ambiguity and feedback averse. The remaining explanation is due to men not liking the uncertainty about their teammate's ability. This result is in line with Durante & Putterman (2008) who found that men, but not women, choose significantly lower taxation rates when pre-tax incomes are determined on the basis of performance in a game rather than randomly. Men seem unwilling to lower their payoffs in order to increase those of a less able participant who they may see as being less deserving.

This experiment provides a way of wiping out the gender gap in tournament entry. However, when looking more closely at the consequences on welfare aspects of the tournament being team-based, it appears that it negatively affects the quality of the

pool of entrants by crowding out the high-performing men from tournament entry. High-performing men seem to be repeled by the uncertainty about their teammate's ability or by the idea that they might help a less deserving participant get higher payoffs by entering the team tournament and as a result they choose not to enter the team tournament even if it means getting lower payoffs. In turn, the average payoff of entrants decreases when the tournament is team-based. There is, nevertheless, a way of getting a gender-balanced pool of entrants without driving away high-performing men from competition by providing contestants with information about their teammate's ability, namely, telling them they will be matched with a teammate of level close to their own.

In the present chapter, I chose not to consider the impact of one's teammate and opponents' gender on her decision to enter competitions. However, it is very likely that this has an impact. Indeed, Niederle *et al.* (2008) showed that a reason why affirmative action was successful in enticing women to enter competition was because women are more comfortable competing against other women. Furthermore, Ivanova-Stenzel & Kübler (2005)'s results suggest that competitive performances are affected by teammates' gender. Future research may therefore focus on the impact of one's teammate and opponents' gender on one's willingness to enter a team competition.

Appendices

Appendix A: Consequences of the Type of Tournament on the Probability of Winning and Expected Payoffs

The consequences of the tournament being team-based on the quality of the pool of entrants and their payoffs will depend on the change in the probability of winning and expected payoffs, all other things being equal, but also on the change in behavior which in turn has an impact on the probability of winning and expected payoffs. Remember that, when entering the team tournament, a participant knows that she will be matched with a teammate who also chose to enter the team tournament. Hence, the level of other participants who chose to enter has an impact on a participant's probability of winning if she enters, as well as on her payoffs if she enters and wins (as each teammate of the winning team earns 1 euro times the average performance of the team). First of all, let us look at Figures 2.9 and 2.10 which represent respectively the probability of winning [8] and the expected payoffs [9]

8. 1.000.000 pairs of opponents' performances were drawn by sampling with replacement from the Task 2 performances of the 76 participants. 1.000.000 teammate's performances were drawn from the Task 2 performances of the potential teammates i.e. of the participants who chose to enter the team tournament. For each level of performance, the probability of winning the individual tournament was computed by calculating the number of times out of 1.000.000 this given performance exceeded the first opponent's performance. Similarly, for each level of performance, the probability of winning the team tournament was computed by calculating the number of times out of 1.000.000 this given performance plus the partner's performance exceeded the sum of both opponent's performances. Finally, the probability of winning the team tournament with a teammate of the same level was found by computing how many times the double of a given performance exceeded the sum of the two opponents' performances.

9. 1.000.000 pairs of opponents'performances and 1.000.000 teammate's performances were drawn by sampling with replacement from the Task2 performances of the 76 participants. For each level of performance, the expected payoff from entering the individual tournament was computed in the following way. For each given performance, the payoff corresponding to each of the 1.000.000 first opponent's performances was computed and averaged. Similarly, for each level of performance, the expected payoff from entering the team tournament was computed by calculating the payoff corresponding to each of the 1.000.000 different sets of one teammate's and two opponents' performances and averaging it.

for each of the three tournaments conditional on performance.

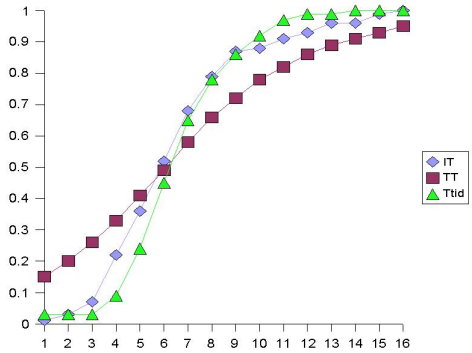

Figure 2.9. Probability of winning the tournaments conditional on performance.

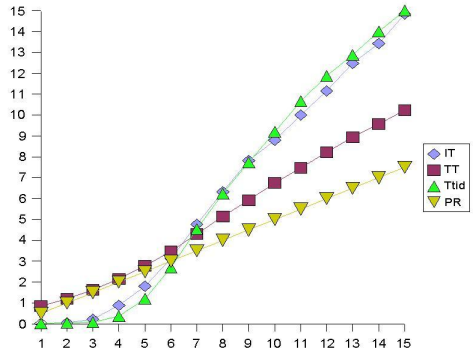

Figure 2.10. Expected payoffs of the tournaments conditional on performance.

It can be seen that while for the individual and the team tournament with a teammate of the same level the probabilities of winning and the expected payoffs are both close, such is not the case for the team tournament. Indeed, the team tournament provides higher expected payoffs than the two other tournaments for low-performing participants and lower expected payoffs for high-performing participants.

The average Task 2 performance of the team tournament entrants (6.52) is lower than the average Task 2 performance of the whole group (6.86) but it is far from being significant. Nevertheless this is not unexpected, as the difference of performance between those who did choose to enter and those who did not is not significant (a two-sided Mann Whitney test yields p=0.30) implying all the more that the difference of performance between the entrants and the whole group is not significant either.

Appendix B: Tasks and What They Control for

The following table is a synthesis of the tasks participants had to complete, how they compare to other tasks and what they allow one to control for.

Table 2.9. Tasks and What They Control For

Tasks	1	2	3	3 bis	4	4 bis	5	5 bis
Remuneration Scheme	piece rate (PR)	Tournament (IT)	piece rate vs Tournament	**Submit** Task1 perf to piece rate vs Tournament	piece rate vs team tournament (TT)	**Submit** Task1 perf to piece rate vs team tournament	piece rate vs team tournament with a teammate of same level (TTid)	**Submit** Task1 perf to piece rate vs team tournament with a teammate of same level
Link to other Tasks			Choice Between Task1 and Task2	=Task3 Except No Performance Needed	=Task3 Except the Tournament is Team-based	= Task4 Except No Performance Needed	= Task4 + info about Teammate's Performance	= Task5 Except No Performance Needed
Controls for	Benchmark and Performance Measure	Benchmark and Performance Measure	Gender Gap in IT	Risk, Ambiguity, Feedback Aversion	Gender Gap in TT	Risk, Ambiguity, Feedback Aversion	Taste for Uncertainty on Teammate's Ability	Risk, Ambiguity, Feedback Aversion

Instructions

The experiment is composed of 8 tasks. Before each task, you will be carefully explained what the task is about and have the opportunity to ask as many questions as you need. Please remember that you are not allowed to communicate in any way with one another. At the end of the experiment two of the eight tasks you will have completed will be randomly chosen to determine your payoffs.

Task 1. Piece Rate: In task 1, you will have 3 minutes to solve as many additions of 5 two-digits numbers as you can. You are allowed to use the scratch paper you have been given. If Task 1 is one of the two tasks randomly chosen for payment, you will receive 50 cents per addition correctly solved. At the end of Task 1, a screen will indicate you how many additions you solved correctly.

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Task 2. Individual Tournament: You will have 3 minutes to solve as many additions of 5 two-digits numbers as you can. If Task 2 is chosen for payment, you will receive 1 euro per correct answer if you solved more additions than a randomly chosen opponent present in the room, otherwise you will receive nothing. You will earn 50 cents per addition correctly solved in case of a tie.

At the end of Task 2, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament only at the end of the experiment.

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Task 3. Choice between Piece Rate and Individual Tournament: Before performing your 3 minutes of additions, you will have to choose whether you want to be paid according to the Piece Rate (50 cents per correct answer) or the Individual Tournament compensation scheme.

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during Task 3.

If you select the tournament, you will receive 1 euro per correct answer if your Task 3 performance exceeds the Task 2 performance of a randomly chosen opponent, otherwise you will receive nothing. You will earn 50 cents per addition correctly solved during Task 3 in case of a tie.

At the end of Task 3, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment.

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Task 3 bis. Choice between *submitting* Task 1 performance to Piece Rate or Individual Tournament: No additions to do here, the performance which will determine your payoffs is your Task 1 performance.

If you choose to submit your Task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your Task 1 performance to the individual tournament, you will receive 1 euro per addition correctly solved in Task 1 if you solved more additions in Task 1 than your randomly chosen opponent, otherwise you will receive

nothing. You will earn 50 cents per addition correctly solved during Task 1 in case of a tie.

You will know whether you won your tournament, if you choose to submit your Task 1 performance to the tournament, only at the end of the experiment.

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Task 4. Choice between Piece Rate and Team Tournament: You have to choose whether they want to be paid according to the Piece Rate or the Team Tournament. The Team Tournament is a two to two competition.

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during Task 4.

If you choose the Team Tournament, two opponents will be randomly drawn among the other participants present in the room. One teammate will be randomly drawn among the participants who chose the team tournament. If the number of additions solved by your team during Task 4 exceeds the number of additions solved by the opposing team during Task 2, each teammate of your team will receive 1 euro times the average score of the team. Otherwise, you will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 4 in case of a tie.

At the end of Task 4, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment. You will not know either your teammate's performance until the end of the experiment.

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Task 4 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament: No additions to do here, the performance which will determine your payoff is your Task 1 performance.

If you choose to submit your Task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your Task 1 performance to the Team Tournament, two opponents are randomly drawn among the other participants present in the room. One teammate is randomly drawn among the participants who chose to submit to the Team Tournament. If the number of additions solved by your team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, you and your teammate will each receive 1 euro times the average score of the team. Otherwise, you will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 1 in case of a tie.

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Task 5. Choice between Piece Rate and Team Tournament with a teammate of the same level (TTid henceforth):

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during task 5.

If you choose the Team Tournament with a teammate of the same level, two opponents will be randomly drawn among the other participants present in the room. Your teammate will be the participant, who chose the team tournament with a

teammate of the same level, whose Task 2 performance was the closest to your own Task 2 performance. If the number of additions solved by your team during Task 5 exceeds the number of additions solved by the opposing team during Task 2, you and your teammate will each receive 1 euro times the average Task 5 score of your team. Otherwise, you and your teammate will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 5 in case of a tie.

At the end of Task 5, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment. You will not know either your teammate's performance until the end of the experiment.

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Task 5 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament with a teammate of the same level: No additions to do here, the performance which will determine your payoff is your Task 1 performance. If you choose to submit your task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your task 1 performance to the team tournament with a teammate of the same level, two opponents will be randomly drawn from among the other participants present in the room. Your teammate will be the participant, who chose to submit to the team tournament with a teammate of the same level, whose Task 2 performance was the closest to your own Task 2 performance. If

the number of additions solved by your team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, you and your teammate will each receive 1 euro times the average score of their team. Otherwise, you and your teammate will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 1 in case of a tie.

NEXT PAGE

Belief-assessment Questions The experiment is now almost over. You just have to answer a few questions about the experiment. For each correct guess, you will earn 1 additional euro.

At Task 4, whether you chose to enter the team tournament or not, two opponents were randomly drawn among the other participants present in the room. One teammate was randomly drawn among the participants who chose the Team Tournament. Knowing that your own Task 2 performance will be recalled to you on the next screen, please guess the task 2 performances of your 2 opponents and your teammate. Also guess the Task 2 performance of the average participant present in the room.

At Task 4 bis, whether you chose to enter the team tournament or not, two opponents were randomly drawn among the other participants present in the room. One teammate was randomly drawn among the participants who chose the to submit their Task 1 performance to the Team Tournament. Knowing that your own Task 1 performance will be recalled to you on the next screen, please guess the Task 1 performances of your 2 opponents and your teammate. Also guess the Task 1

performance of the average participant present in the room.

Chapter 3

Group Identity and Competitiveness

3.1. Introduction

Women are widely under-represented in top-level social positions. While several potential reasons may explain this fact (Goldin & Rouse, 2000, Altonji & Blank, 1999), recent findings have emphasised one specific cause as particularly relevant: women are less likely to self-select into competitions (Gupta *et al.*, 2005, Niederle & Vesterlund, 2007, Niederle *et al.*, 2008).

The previous chapter shows that many men stay out of competition when it is team-based so that there is no gender gap in team tournament entry. This result is mainly due to high-performing men being repelled by the idea of helping a probably less able participant increase her payoffs. Indeed, high-performing men are willing to enter the team tournament, *but only provided that they will be matched with a teammate of level close to their own.* While high-performing men have an obvious interest in being matched with another highly efficient teammate, this may also

suggest that they gain utility from performing with a teammate they share characteristics with. In other words, being in the same team sometimes means something more than a change in expected payoffs. If such is the case, performing at a similar level may act as an implicit common identity. It is then interesting to study whether an explicit, artificially-created, group identity would have similar effects. Indeed, a lot of competitions oppose groups of individuals who share some attributes whether it is a sport games opposing two nations or two firms competing for clients.

The aim of this second chapter is to study how the creation of a group identity affects men and women's willingness to enter competitive environments.

The impact of group identity on economic behaviors has lately become of keen interest to economists. Standard economic theory assumes economic agents act as isolated individuals. However, individuals often perceive themselves as member of social groups and this may well have an impact on the decisions they have to make. If such is the case, understanding how group identity affects economic decisions would be crucial [1]. Akerlof and Kranton emphasize how social identity may affect economic outcomes (Akerlof & Kranton, 2000, 2002, 2005). Following their work, experimental economists have been interested in studying how social identity changes individual behavior. Converging results indicate that individuals take more socially-oriented decisions when they deal with fellow group members rather than with random participants or outgroup members. For instance, Chen & Li (2009) finds that participants behave more altruistically with an ingroup match than with

1. The social identity theory has been developped by Tajfel (Tajfel, 1970, Tajfel *et al.*, 1971, Tajfel & Turner, 1979, 1986).

an outgroup. Charness *et al.* (2007) show that when group membership is made salient, either by common payoffs or by letting an audience of group members watch the decision-maker, decisions tend to favor more the payoffs of the whole group. Eckel & Grossman (2005) also find that a strong enough social identity increases cooperation significantly among the group. Given these results, one should expect social identity to influence decisions to compete, especially as part of a team. In an investment experiment, Sutter (2009) finds that the decisions made individually by one group member are very similar to the decisions taken jointly by all the members of a team.

The experimental design of this chapter is based on that of the previous chapter and compares the competitive behavior of subjects who have been through preliminary "group identity-building" activities (Identity sessions) to that of subjects who have not (Benchmark sessions). I chose to artificially create a group identity in the lab so as to be able to control for whatever subjects bring into the lab. When entering the room, participants from the Identity sessions were randomly assigned to one of two groups and could communicate within their group through an instant message system in order to choose a name for their group. They then had to perform a collective task during which they could also use the instant message system to communicate with the members of their group. After this first "group identity creation" phase was over, participants were not able to communicate. The second phase of the Identity sessions corresponds to the experimental design of the seconf chapter: Participants had to go through several tasks for which their payoffs

depended on how many additions they could solve in a given period of time. At some points, they were asked to make choices between two available remuneration schemes, one individual - a piece rate- and one that is team-based. In the Identity sessions, one's teammate belonged to her group and one's opponents belonged to the other group, while, in the Benchmark sessions, one's teammate and opponents were just participants present in the room. The choices made during the second phase of the Identity sessions were compared to those made during the Benchmark sessions for which there was no previous attempt to build a group identity.

If one of the reasons why high-performing men engage in team competition only with a teammate of the same level is because they need to share a common characteristic with their teammate, one would expect high-performing men to enter team competition at higher rates when their teammate is a fellow group member. Since team competition makes women a little more likely to enter the tournament, one could expect group identity to further increase women's willingness to enter the team tournament.

The main result is that, while high performing men from the Identity sessions were not willing to enter the team competition unless they were matched with a teammate of the same level, it was not the case in the Identity sessions where men did not opt out from the team competition when their teammate was a fellow group member. Indeed, high-performing men are less reluctant to be matched with a possibly less able participant when he or she belongs to his group. It then seems that high-performing men are not likely to enter a team competition unless they

know their teammate will either be of level close to their own or share a social identity with them. I also found that, somehow surprisingly, women, and more precisely low-performing women, are less willing to enter competitive environments when being a member of a group and that they are less afraid of dragging down a possibly more efficient teammate when he or she belongs to her group than when he or she is a random participant. Two additional sessions were run using gender to form groups. Results imply that male vs female competition does not change much competitive behaviors in comparison with what happens in the Benchmark sessions where one does not know the gender of her opponent(s) and teammate. In particular, men are not more likely to help out their probably less able teammate when he is another man than when his or her gender is unknown.

The rest of the chapter is organized as follows. The experimental design is presented in section 2. Section 3 provides the results and section 4 discusses them. Finally, section 5 concludes.

3.2. Experimental Design

This chapter compares the competitive behavior of subjects who have been through group-identity-building activities (Identity sessions) to that of subjects who have not (Benchmark sessions). In the Identity sessions, participants were randomly separated in two groups and had to participate in activities meant to create a group identity before going through 8 tasks. In the Benchmark sessions, participants directly went through the 8 tasks without previously experiencing the creation of a

group identity. During those 8 tasks, subjects had to participate to one tournament and had several opportunities to choose to enter tournaments. In the Identity sessions, one's opponent(s) in the tournaments one engaged in were members of the other group and her teammate, if she had any, belonged to the same group as her own. On the other hand, in the Benchmark sessions, one's tournament opponent(s) and teammate were just participants present in the room.

3.2.1. Identity sessions

3.2.1.1. Creation of a Group Identity

Subjects entered the experimental laboratory and each sat in front of a computer. They were randomly assigned to one of two groups by the computer but did not know who was and was not part of their group.

Choice of a Group Name: Participants were told that they had two minutes to communicate through a chat program on their computers with the other group members to find a name to their group. Two chat programs were set so that communication was possible within the members of each group but participants of different groups could not communicate. After the two minutes were up, each participant had to enter his or her choice of group name. If all members of a group did not agree on a name, the name that most members chose was considered to be the group name. The names of both group were publicly announced by the experimenter so as to further help trigger a sense of group membership.

Quizz: Participants had to answer to a four questions quizz. Since participants

did ot know each other previous to the experimental session, it seemed necessary to add a group activity to the choice of a group name. For each question, four possible answers were available and participants had two minutes to discuss what they thought was the correct answer within their own group. At the end of the two minutes, each participant had to enter his or her answer knowing that the answer validated for the whole group would be the one chosen by a majority of members. Each member could earn 1 euro if the answer validated for his or her group was correct. Participants did not learn the correct answer and the answers chosen by the other members of their group until the end of the experiment.

3.2.1.2. The Tasks

This part of the experimental design builds on that of Niederle & Vesterlund (2007), henceforth NV. The exercise subjects were asked to perform is the same as in NV: additions of five 2-digit numbers.

Participants were told that they had to complete eight tasks of which two would be randomly chosen for payment at the end of the experiment. At the end of each task, participants were informed of their absolute performance (the number of additions they correctly solved) but were not informed of their relative performance until the end of the experiment. In a standard task, participants had to choose between a piece rate and a remuneration scheme involving competition (a tournament) before having three minutes to solve as many additions as they could. The compensation schemes available changed between tasks and participants were informed of their

nature only immediately before performing the task. Each time a tournament was available, participants were informed that their opponents would be members of the other group while their teammate, in the case of team competition, would be a member of their own group. I made the participants from the Identity sessions go through the 8 same tasks as the participants from the Benchmark sessions so as to be able to properly compare the behaviors of participants from both kinds of sessions. This section details the tasks participants had to go through.

Task 1. Piece Rate: Participants are given the three-minute addition exercise. If Task 1 is randomly chosen for payment, they receive 50 cents per correct answer.

Task 2. Individual Tournament: Participants are given the three-minute addition exercise. If Task 2 is chosen for payment, the subject receives 1 euro per correct answer if she solved more additions than her opponent randomly chosen among the other group, otherwise she receives nothing.

Task 3. Choice between Piece Rate (PR henceforth) and Individual Tournament (IT henceforth): Before they perform their additions, subjects have to choose whether they want to be paid according to the Piece Rate (50 cents per correct answer) or the Individual Tournament compensation scheme. A participant who selects the tournament receives 1 euro per correct answer if her Task 3 performance exceeds the Task 2 performance of her opponent randomly chosen among the other group, otherwise she receives nothing. Subjects are competing against a past competitive performance of their opponent so that the decision to enter the tournament is not affected by beliefs about whether the opponent is going to enter.

In addition, it allows one to rule out the possibility that a participant may not enter because she may fear to inflict losses on her opponent.

Task 3 bis. Choice between *submitting* Task 1 performance to Piece Rate or Individual Tournament: No additions to do here, the performance which will determine the payoff is the Task 1 performance. If a participant chooses to submit her Task 1 performance to the Piece Rate, she receives 50 cents times her Task 1 performance. If she chooses to submit her Task 1 performance to the Individual Tournament, she receives 1 euro per addition correctly solved in Task 1 if she solved more additions than her opponent randomly chosen among the other group, otherwise she receives nothing. Task 3 bis is identical to Task 3 (in both cases the tournament is a more risky choice implying more ambiguity and subjecting the participant to feedback at the end of the experiment concerning whether she beats her opponent) except for the fact that it does not involve a future performance. In particular, the participant who chooses to submit her past performance to the tournament does not have to perform under the pressure of competition. In consequence, any change in behavior between Tasks 3 and 3 bis will be attributed to the taste for performing in a competitive environment.

Task 4. Choice between Piece Rate and Team Tournament: Subjects have to choose whether they want to be paid according to the Piece Rate or the Team Tournament. The Team Tournament is a two to two competition. If a participant chooses the Team Tournament, two opponents are randomly drawn among the members of the other group. One teammate is randomly drawn among the members of

the participant's group who chose the Team Tournament. [2] This implies that a subject who chooses to enter the Team Tournament knows that her teammate will have made the same choice so that both teammates will be competing at the same time against their opponents, facilitating the emergence of a team spirit. If the number of additions solved by one's team during Task 4 exceeds the number of additions solved by the opposing team during Task 2, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing.

Task 4 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament: No additions to do here, the performance which will determine the payoff is the Task 1 performance. If a participant chooses to submit her Task 1 performance to the Piece Rate, she receives 50 cents times her Task 1 performance. If she chooses to submit her Task 1 performance to the Team Tournament, two opponents are randomly drawn among the members of the other group. One teammate is randomly drawn among the members of the participant's group who chose to submit to the Team Tournament.[2] If the number of additions solved by one's team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing. Task 4 bis is identical to Task 4 (considering overconfidence, risk aversion and uncertainty about teammate's ability) except for the fact that it does not involve a future performance. In particular, the

2. If only one member of a group had chosen the team tournament, which never happened, she would have been matched with a member of her group who had chosen the piece rate. Also, if an uneven number of group members chose the team tournament, participants were paired and a teammate was randomly chosen among them whose performance was added to the remaining participant's performance to compute the score of her team

participant who chooses to submit her past performance to the Team Tournament does not have to perform under the pressure of competition. In consequence, any change in behavior between Tasks 4 and 4 bis will be attributed to the taste for performing in a team competition.

Task 5. Choice between Piece Rate and Team Tournament with a teammate of the same level (TTid henceforth): If a participant chooses the Team Tournament with a teammate of the same level, two opponents are randomly drawn among the members of the other group. One teammate is attributed from among the members of the participant's group who chose the Team Tournament: the participant whose Task 2 performance was the closest to the participant's own Task 2 performance. If the number of additions solved by one's team during Task 4 exceeds the number of additions solved by the opposing team during Task 2, each teammate receives 1 euro times the average Task 5 score of their team. Task 5 resembles Task 4 in that the subjects have to choose between a Piece Rate remuneration and a Team Tournament but in Task 5 the uncertainty about one's teammate's ability at solving additions (or at least part of it) is taken away. Then, assuming that learning effects are the same for men and women, if men's and women's behavior changes in a different way between Task 4 and Task 5, it will be attributed to a different reaction to the uncertainty about one's teammate's ability.

Task 5 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament with a teammate of the same level: No additions to do here, the performance which will determine the payoff is the Task 1 performance.

If a participant chooses to submit her Task 1 performance to the Piece Rate, she receives 50 cents times her Task 1 performance. If she chooses to submit her Task 1 performance to the TTid, two opponents are randomly drawn from among the members of the other group. One teammate is attributed from among the members of the participant's group who chose the Team Tournament: the participant whose Task 2 performance was the closest to the participant's own Task 2 performance. If the number of additions solved by one's team during Task 1 exceeds the number of additions solved by the opposing team during Task1, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing.

Belief-assessment Questions

A difference in confidence between men and women may explain a significant part of the gender gap in tournament entry. NV and NSV found that both men and women are overconfident but men are more so. In order to control for differences in confidence both in one's chances of winning the Individual Tournament and in one's team chances of winning the Team Tournament, participants had to answer belief-assessment questions at the end of the experiment. Participants had to guess the mean Task 2 performance of members of their own group and of the other group.

The participants were recalled that during Task 4 they had to choose between a Piece Rate and a Team Tournament, for which two opponents were randomly drawn from among the members of the other group and a teammate was randomly drawn from among the members of the participant's group who had chosen the Team Tournament. They were also told that even if they had chosen the Piece

Rate at Task 4, two opponents and one teammate had still been randomly chosen in the exact same way. Their own Task 2 performance was recalled to them and participants had to guess the Task 2 performances of their teammate and opponents chosen during Task 4.

A participant knew she would earn 1 euro per correct guess.

3.2.2. Benchmark sessions

The experimental design in the Benchmark sessions was the same as that of Identity sessions, except that participants did not go through the creation of a group Identity but started with the tasks. Also, in each tournament the participant had or wanted to participate in, her opponent(s) were randomly chosen among all the other participants present in the room and, in the case of the team tournament (TT) and team tournament with a teammate of the same level (TTid), her teammate was one of the other participant present in the room who also chose to enter the same team tournament.

3.3. Results

The experiment was run at the Parisian Experimental Economics Laboratory (LEEP) of Paris 1 University.[3]

39 men and 37 women took part in the Benchmark sessions, while 52 men and 38 women participated in the Identity sessions adding up to a total of 166 participants.

3. Subjects were recruited through the online recruitment system ORSEE (Greiner, 2004). The experiment was computerized using the REGATE software (Zeiliger, 2000).

There were 6 Benchmark sessions and 5 Identity sessions. The proportion of women in these sessions varied respectively between 31% and 71% for the Benchmark sessions and between 31% and 50% in the Identity sessions. The average participant earned 15,86 euros in the Benchmark sessions and 17.38 including a 7-euro show-up fee.

In this section, after describing the unfolding of the group identity building activities, I investigate how group identity affects performance and the decision to enter the individual tournament. I then study the effect of group identity on team tournament entry. Finally, the different impact of group identity for men and women is analyzed.

3.3.1. Group identity building activities

In the Identity sessions, the first thing subjects had to do was use the instant message system to find a group name with their fellow group numbers. The name chosen for each of the two groups in each of the 5 sessions were [4]: Groupex (for experimental group), FunBossTeam, Cosmos, Icare (Icarus), Jackson, Bogoss (phonetic for "beaux gosses" which approximately means hot guys), Cobaye (Guinea Pig), Groupe 1 (Group 1), Happy Face and Cosmopolites. Depending on the sessions and the groups, the group members were more or less fast in reaching a consensus. In order to take these differences into account, in the following of the chapter, session dummies were added in the regressions concerning the participants to the Identity

4. If needed, the translation is in brackets.

sessions. Nevertheless, the coefficients of these sessions dummies were never found to be significant, suggesting that the response to group identity does not depend heavily on the session one belonged to.

3.3.2. The effect of social identity on performance, confidence and entry in the individual tournament

In this subsection, the changes in performance, confidence and decision to enter the individual tournament between subjects who have not experienced the creation of a group Identity and those who have are investigated.

3.3.2.1. How social identity impacts performance and confidence in one's chances to win the individual tournament

For both men and women, the Task 1 and Task 2 performances are lower among participants with a group Identity. However, the difference is significant only for the Task 2 performance of men (a two-sided Mann Whitney test yields p=0.05) who solved on average 7.4 additions during the Benchmark sessions and 5.9 during the Identity sessions. Furthermore, while men from the Benchmark sessions performed significantly (p=0.04) better under the tournament remuneration scheme (Task 2) than under the piece rate (Task 1), such is not the case in the Identity sessions in which performances are not significantly different between Task 1 and 2 neither for men (p=0.12) nor for women (p=0.51).

In addition to performance, what can also explain the decision to enter the in-

dividual tournament is the confidence in one's chances to win the tournament. In order to make it possible to compute a measure of overconfidence, participants had to answer several belief-assessment questions. In particular, they had to guess the Task 2 performance of a randomly chosen participant present in the room. Subjects taking part in the Identity sessions also had to guess the Task 2 performance of a randomly chosen member of the other group present in the room. From these answers, the dummy variable guesswin equal to 1 if the participant's beliefs are consistent with winning the tournament, and to 0 otherwise, was computed in the following way. In the Benchmark sessions, guesswin is set equal to 1 if a subject thinks the Task 2 performance of a randomly chosen participant is lower or equal to her own Task 2 performance, and to 0 otherwise. In the Identity sessions, guesswin is set equal to 1 if a subject thinks the Task 2 performance of a randomly chosen member of the other group is lower or equal to her own Task 2 performance, and to 0 otherwise. Given Tajfel (1970)'s results who found that minutes are sufficient for individuals, who have been divided into different groups following minimal criteria, to feel their own group as superior, one would expect subjects from the Identity sessions to be more confidence in their chances of winning than subjects from the Benchmark sessions.

78% of women in the Benchmark sessions and 58% in the Identity sessions think they are likely to win the individual tournament. This difference is significant (a two-sided Mann Whitney test yields p=0.06) indicating that women who experienced the creation of a group Identity are actually less confident than those who did not.

One explanation for this could be that the group identity building activities actually made women uncomfortable therefore decreasing their confidence in their chances to beat their opponents. Another reason could come from the different sex ratio between the Benchmark and the Identity sessions. Indeed while the Benchmark sessions are composed of almost the same number of men and women (39 vs 37), there are more men than women in the Identity sessions (52 vs 38). If women believe that men are on average better than women, this could explain why they are less confident in their chances of winning when they are more likely to be competing against a man [5]. As for men, respectively 85% and 83% (p=0.81) in the Benchmark sessions and the Identity sessions hold beliefs consistent with winning the individual tournament.

Table 3.1 reports the results of two logit regression with Guesswin as the independent variable on the following regressors: the dummy variable Id (=1 if the participant took part in one of the Identity sessions, 0 if she took part in one of the Benchmark sessions), the dummy variable Female (=1 if the participant is a woman, 0 otherwise), the interaction term Id*Female and Prob (corresponding to the probability of winning the tournament given the participant's performance and the other participants' performances). Even though participants only know their absolute performance and therefore ignore their probability of winning, it is important to include the probability of winning in the regressors in order to know whether the more able participants are more confident in their chances of winning the tourna-

5. In order to check for this possibility, two additionnal sessions were run where the group identity relies on the gender of the participants (the male goup vs the female group). The results are reported in subsection 3.5.

ment. Here, it is clearly the case as Prob is positive and highly significant. It can be seen, from the first regression, that women and participants to the Identity sessions are less likely than, respectively, men and participants to the Benchmark sessions, to hold beliefs consistent with winning the tournament. However, when adding the interaction term Id*Female to the regressors, Id and Female are no longer significant suggesting that the lower confidence of women and participants to the Identity sessions is mainly driven by women who participated in an Identity session.

Table 3.1: Logit of Guesswin (Task 3)

Regressors	(1)	(2)
Id*Female		-0.39
		(0.16)
Id	-0.08	0.07
	(0.08)	*(0.90)*
Female	-0.12	0.05
	(0.02)	*(0.70)*
Prob	0.55	0.55
	(0.00)	*(0.00)*
Observations	90	90

Logit regressions.
The table presents marginal effects computed at a man with a 50% chance of winning the tournament. P-values are in brackets.

3.3.2.2. The effect of social identity on the decision to enter the individual tournament

In Task 3, participants were asked to choose between a piece rate and a tournament, knowing that they would win their tournament if they correctly solved more additions during Task 3 than a randomly chosen opponent (belonging to the other group for the Identity sessions) during Task 2. The most obvious guess would have

been that group identity increases the number of participants willing to enter the individual tournament.

In the Benchmark sessions, 51% of women and 85% of men chose to enter the tournament (a two-sided Fisher's exact test yields p=0.00). In the Identity sessions, 32% of women and 75% of men (p=0.00) made such a choice. While, in both cases, men chose the tournament significantly more often than women, one can also notice that participants to the Identity sessions entered the competition less often than their counterparts from the Benchmark sessions. Looking closer at these differences in tournament entry between treatments, it appears that while men's decision to enter the tournament is not significantly different between treatments (p=0.31), women from the Identity sessions choose marginally significantly (p=0.10) less often the tournament than women from the Benchmark sessions. Again, the fact that the proportion of men is higher in the Identity sessions could help explain why fewer women enter the tournament if they think they are less likely to beat a male opponent.

Figures 3.1 and 3.2 represent, for both treatments, the proportion of men and women of each performance level (below and above the median performance) choosing the tournament. It appears that while men from the Benchmark sessions chose the tournament all the more that their performance was high (a two-sided Fisher's exact test yields p=0.01), the choice of men from the Identity sessions does not seem to depend on their performance level (p=1.00). On the contrary, when high-performing women from the Benchmark sessions do not enter the tournament more

often than their low-performing counterparts (p=1.00), women from the Identity sessions seem to be acting more strategically, entering more if their performance is high (p=0.08).

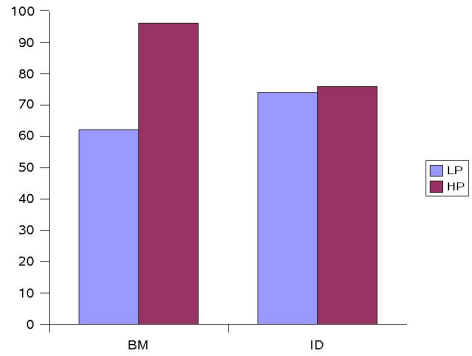


Figure 3.1. Proportion of low-performing and high-performing men from Benchmark (BM) and Identity (ID) sessions entering the individual tournament.

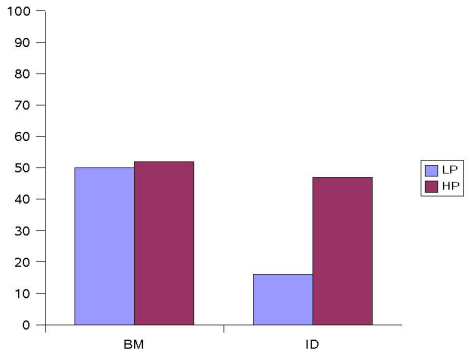


Figure 3.2. Proportion of low-performing and high-performing women from Benchmark (BM) and Identity (ID) sessions entering the individual tournament.

The regressions (1) concerning respectively the Benchmark subjects and the Identity subjects reported in table 3.2 confirm that, in both treatments, conditional on the probability of winning the tournament [6], women choose the tournament less often even if it is true to a greater extent in the Identity sessions since the coefficient of Female is more negative in the regression concerning the Identity participants, even though the coefficient of the interaction term Id*Female is not significant in the regression on all participants. The interaction term Female*Prob (where Prob is the probability of winning the tournament given the subject's performance and the performances of other subjects in her treatment) is added to the regressors. It appears that, in the Benchmark sessions, the gender gap in tournament entry

6. Even though the probability of winning is unknown to the participant, including it to the regressors allows one to compare the efficiency of the different tournaments (Does a given tournament lead the better participants to self-select into it?).

is mainly due to high-performing men choosing the tournament more often than high-performing women, while, in the Identity sessions, it is smoothed over (since the coefficient of Female increases when Female*Prob is introduced in the regressors) by high-performing women entering the tournament more often than their less performing counterparts and at similar rates than men.

It can be seen from the first regression concerning all subjects that participants from the Identity sessions choose the tournament less often than participants from the Benchmark sessions. However, the second regression suggests that this result is driven by female participants from the Identity sessions being less competitive than their counterparts from the Benchmark sessions since the addition of the interaction term Id*Female makes the coefficent of Id become close to zero and lose significance. The third and fourth regressions confirm that high-performing women, and more precisely high-performing women from the Identity sessions are drawn to the competition. Indeed, when the interaction term Prob*Female is added in the third regression, the coefficient of Female decreases from -0.24 to -0.37, indicating that if it were not for high-performing women, women would be repelled by competition even more. Furthermore, the addition of Id*Female*Prob (p=0.10) makes the coefficient of Id*Female become more negative and more significant while the coefficient of Female loses significance, suggesting that women tend to be less competitive in comparison to men when belonging to a social goup and having to compete against a member of the other group, but high-performing women reduce this effect. In consequence, it appears that low-performing women from the Identity sessions are most

responsible for the worsening of the gender gap since they enter at lower rates than low-performing women from the Benchmark sessions, as can be seen from figure 3.2.

Table 3.2: Logit of Tournament-Entry Decision (Task 3)

Regressors	Benchmark		Identity		All			
	(1)	(2)	(1)	(2)	(1)	(2)	(3)	(4)
Id*Female						-0.21	-0.22	-0.59
						(0.67)	*(0.64)*	*(0.11)*
Id					-0.11	-0.01	-0.01	-0.04
					(0.04)	*(0.28)*	*(0.28)*	*(0.28)*
Female	-0.32	-0.07	-0.45	-0.71	-0.35	-0.24	-0.37	-0.23
	(0.01)	*(0.64)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.02)*	*(0.22)*
Prob	0.36	0.92	0.28	-0.03	0.30	0.30	0.23	0.22
	(0.05)	*(0.02)*	*(0.12)*	*(0.78)*	*(0.02)*	*(0.02)*	*(0.19)*	*(0.19)*
Female*Prob		-0.84		0.74			0.15	-0.13
		(0.07)		*(0.03)*			*(0.55)*	*(0.64)*
Id*Female*Prob								0.62
								(0.10)
Observations	76	76	90	90	166	166	166	166

Logit regressions.
The table presents marginal effects computed at a man in the Benchmark sessions with a 50% chance of winning the tournament. P-values are in brackets.
Session dummies were added in the Identity regressions but none were significant.

These first results imply that the attempt to create a group Identity has caused women, and more precisely low-performing women to shy away even more from competition. They also tend to show that the membership to a group makes men act less strategically while, if anything, the opposite seems to be true for women.

The regressions reported in table 3.3 may help us understand these first results by assessing the role of beliefs (Guesswin) and risk, ambiguity and feedback aversion (Submit) in the decision to enter the individual tournament. The dummy variable Submit is equal to 1 if the participant's Task 3 bis decision was to submit her Task 1 performance to the individual tournament, and to 0 otherwise. Task 3 and 3 bis decisions are very similar except for the fact that Task 3 bis does not

involve a subsequent performance. In consequence, Task 3 bis allows one to control for everything that can explain the decision to enter the individual tournament (confidence in one's chances to win, risk, ambiguity and feedback aversion) except for the taste for competition. Since a control for confidence was already included in the regressors (Guesswin), the decision to submit a past performance to the individual tournament adds a new control for risk, ambiguity and feedback aversion.

Table 3.3: Logit of Tournament-Entry Decision (Task 3)

Regressors	Benchmark			Identity			All			
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(4)
Id*Female								-0.21	-0.20	-0.25
								(0.67)	*(0.98)*	*(0.99)*
Id							-0.11	-0.01	0.03	0.06
							(0.04)	*(0.28)*	*(0.28)*	*(0.27)*
Female	-0.32	-0.27	-0.17	-0.45	-0.38	-0.37	-0.35	-0.24	-0.19	-0.11
	(0.01)	*(0.01)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Prob	0.36	0.18	0.01	0.28	0.10	0.07	0.30	0.30	0.11	0.02
	(0.05)	*(0.30)*	*(0.96)*	*(0.10)*	*(0.60)*	*(0.69)*	*(0.02)*	*(0.02)*	*(0.40)*	*(0.85)*
Guesswin		0.41	0.34		0.26	0.20			0.31	0.27
		(0.01)	*(0.00)*		*(0.06)*	*(0.10)*			*(0.00)*	*(0.00)*
Submit			0.15			0.28				0.20
			(0.01)			*(0.01)*				*(0.00)*
Observations	76	76	76	90	90	90	166	166	166	166

Logit regressions.
The table presents marginal effects computed at a man in the *Benchmark* sessions with a 50% chance of winning the tournament. P-values are in brackets.
Session dummies were added in the Identity regressions but none were significant.

The first noticeable fact is that, whereas beliefs and risk, ambiguity and feedback aversion help explain part of the gender gap in tournament entry in both the Benchmark and Identity sessions (the coefficient of Female gets closer to zero when adding Guesswin and Submit into the regressors), the residual unexplained gender gap is almost twice as important in the Identity sessions. This suggests that the

attempt to create a group Identity has increased women's fear of competition. Section 4 provides some intuitions of why this could be the case. Indeed, women are not significantly less likely to submit a past performance to the individual tournament when they took part in the Identity sessions rather than in the Benchmark sessions (a two-sided Fisher's exact test yields p=0.82) but they are (marginally) significantly less likely to enter the individual tournament (p=0.10). The regressions on the whole pool of participants confirm that risk, ambiguity and feedback aversion do not help explain why women from the Identity sessions enter less than their counterparts from the Benchmark sessions (since the coefficient of Id*Female becomes even more negative when Submit is added to the regressors).

3.3.3. The effect of social identity on entry in the team tournament

If, as suggested by past experimental evidence (Eckel & Grossman, 2005, Brewer & Kramer, 1986), group identity shifts individual behaviors from self-interest towards the interest of the whole group, one would expect men and especially high-performing men, not to shy away from the team tournament when competing with a fellow group member against two members of the other group. Furthermore, since women from the Benchmark sessions entered the team tournament more often (even if not significantly so) than the individual tournament, one may guess that the goup identity would further increase their willingness to compete as part of a team.

In the Benchmark sessions, 62% of women and 59% of men (p=0.82 with a two-sided Fisher's exact test) chose to enter the team tournament. In the Identity

sessions, 42% of women and 69% of men (p=0.02) made such a choice. In consequence, team competition which was successful in eliminating the gender gap in tournament entry in the Benchmark sessions failed to do so in the Identity sessions. Yet, in both treatments, women choose the tournament more often when it is team based, even if not significantly so (p=0.48 in both the Benchmark sessions and the Identity sessions). Men's behavior, on the other hand, is not the same over the two treatments. While, in the Benchmark treatment, men entered the tournament significantly less often when they were part of a team rather than alone (p=0.02), in the Identity treatment, they chose the tournament almost as often whether it was individual or team-based (p=0.66). These patterns can be observed on figures 3.3 and 3.4.

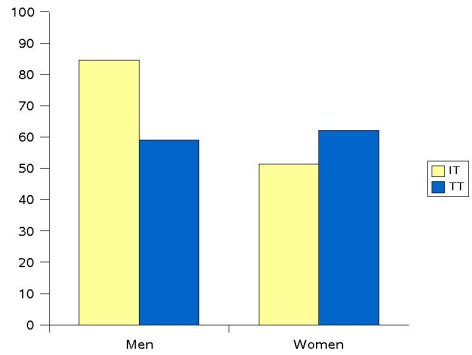


Figure 3.3. Proportion of men and women from Benchmark sessions entering the individual tournament (IT) and team tournament (TT).

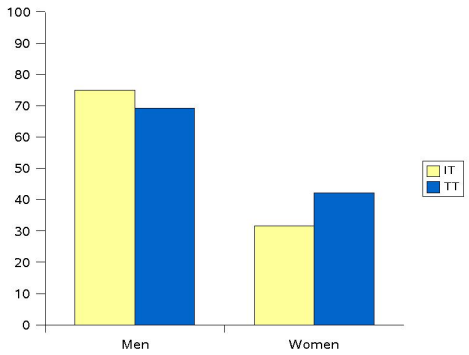


Figure 3.4. Proportion of men and women from Identity sessions entering the individual tournament (IT) and team tournament (TT).

Table 3.4 reports the results of regressions of the decision to enter a tournament on the following regressors: the dummy variable Id (=1 if the participant took part in one of the Identity sessions, 0 if she took part in one of the Benchmark sessions), the dummy variable Female (=1 if the participant is a woman, 0 otherwise), the

interaction term Id* Female, Prob (corresponding to the probability of winning the tournament given the participant's performance and the other participants' performances), the dummy variable Team (=1 if the tournament the participant has to choose whether to enter is team-based, 0 if it is an individual tournament and the interaction term Female*Team. Since both the decision to enter the individual and the team tournament are taken as independent variables, a cluster on the participant is used to take into account the fact that both decisions are not independent for a given individual.

Table 3.4: Logit of Tournament-Entry Decision (Tasks 3 and 4)

Regressors	Benchmark	Identity	All		
			(1)	(2)	(3)
Id*Female			-0.21	-0.27	-0.29
			(0.67)	*(0.10)*	*(0.10)*
Id			-0.01	0.06	0.07
			(0.28)	*(0.93)*	*(0.93)*
Female	-0.21	-0.37	-0.24	-0.09	-0.16
	(0.00)	*(0.00)*	*(0.00)*	*(0.08)*	*(0.00)*
Prob	0.14	0.13	0.30	0.11	0.11
	(0.41)	*(0.42)*	*(0.02)*	*(0.35)*	*(0.37)*
Team	-0.15	0.02		-0.00	-0.07
	(0.01)	*(0.47)*		*(0.57)*	*(0.02)*
Female*Team	0.15	0.06			0.14
	(0.01)	*(0.19)*			*(0.01)*
Observations	152	180	332	332	332

Logit regressions using clusters for each participant.
The table presents marginal effects computed at a man from the *Benchmark* sessions in the individual tournament with a 50% chance of winning the tournament. P-values are in brackets.
Session dummies were added in the Identity regressions but none were significant.

Observing the results of the regressions reported in table 3.4, two main facts are noticeable. Firstly, the coefficient of Team is negative and highly significant in the Benchmark treatment but it is positive and no longer significant in the Identity treatment. As can be seen on figures 3.3 and 3.4, subjects from the Identity sessions

do not enter significantly less in the tournament when it is team-based while this is the case for subjects from the Benchmark sessions (at least for males). Secondly, the coefficient of the interaction term Female*Team is positive and highly significant in the Benchmark treatment while it is not significant in the Identity treatment. It shows that the tournament being team-based rather than individual succeeds in eliminating the gender gap in tournament entry in the Benchmark treatment while it is not the case in the Identity treatment. In the regressions concerning all subjects, adding Team to the regressors makes Id*Female more negative and significant reflecting the fact that the creation of a group Identity has a bigger impact on the gender gap in tournament entry when the tournament is team-based. Indeed, the gender gap in tournament exists in both Benchmark and Identity sessions but, only in the Identity sessions is there a gender gap in entry in the team tournament since men from the Identity sessions do not stay out of the competition while men from the Benchmark sessions do, lowering their entry rate to the level of women's.

3.3.4. Explanations for the changes in decision to enter the team tournament

In the Benchmark sessions, men choose the individual tournament more often than women but many of them stay out of the tournament when it is team-based while, in the same time, women do not significantly change their competitive behavior, resulting in the elimination of the gender gap in tournament entry when the competition becomes team-based. However, when a group Identity has been built, the team competition no longer induces a change in men's competitive behavior and

a gender gap also exists in the team tournament. This subsection aims at further understanding why there is a significant gender gap in team tournament entry in the Identity sessions while there was none in the Benchmark sessions. In particular, this subsection investigates why men no longer react to the competition being team-based when they belong to a social group. Furthermore, as the results concerning the individual tournament suggest women may be acting more strategically when belonging to a social group (women from the Identity sessions enter the individual tournament all the more that their performance is high when it was not the case in the Benchmark sessions) it also seems interesting to see whether it is also the case in the team tournament.

Figures 3.5 and 3.6 are a good illustration of how group identity changes men and women's competitive behavior. In the Benchmark sessions, men entered massively the individual tournament but many of them chose not to participate in the team competition unless they knew they would be matched with a teammate of level close to their own. It then seems that men are unwilling to take the chance of being dragged down by a less efficient temmate. However, if group identity makes men act less in their own interest and more in the interest of their group, one could expect men to more easily accept the possibility of losing because of a less able teammate if he or she is a fellow group member. Indeed, when a group identity has been built, men enter at very similar rates in each of the three tournaments. As for women, it seems from figure 3.6 that the creation of a group identity has just made them less prone to enter each of the three tournaments. Women from the Identity sessions

enter marginally significantly less often than their counterparts from the Benchmark sessions the individual tournament (a two-sided exact fisher's test yields p=0.10) and the standard team tournament (p=0.10) and the difference is more pronounced in the team tournament with ateammate of the same level (p=0.04).

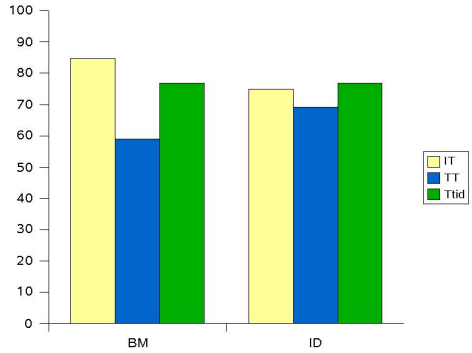


Figure 3.5. Proportion of men from the Benchmark sessions (BM) and the Identity sessions (ID) entering each of the three tournaments.

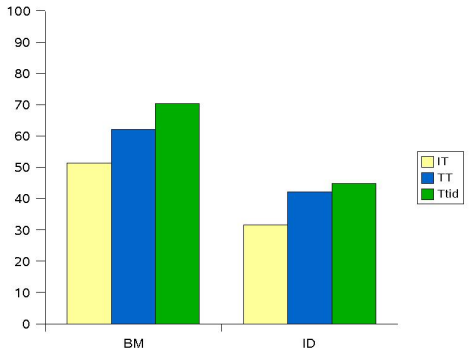


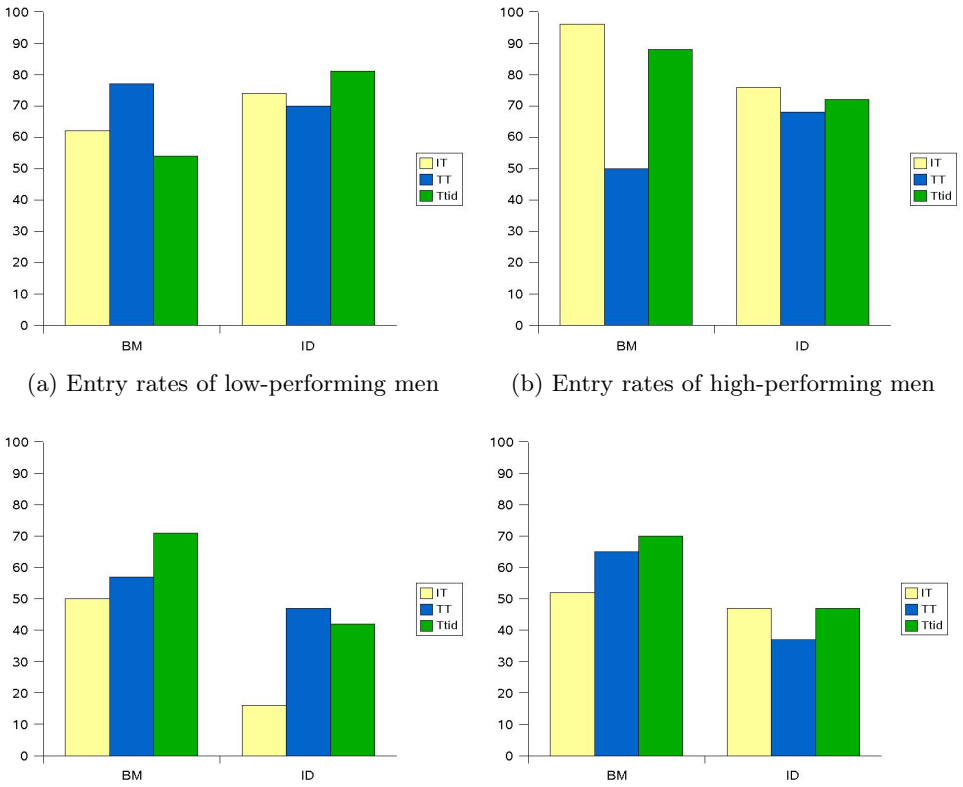
Figure 3.6. Proportion of women from the Benchmark sessions (BM) and the Identity sessions (ID) entering each of the three tournaments.

The change in decision to enter the team tournament provoked by the creation of a group identity seems to be at least partly driven by a change in the way participants react to the uncertainty on their teammate's ability. It is, however, likely that participants respond differently to this uncertainty depending on their own ability level. Indeed, a participant driven by selfish motives will have more interest in entering the team tournament with a teammate of the same level than the standard team tournament if her own performance is high but the contrary will be true for a low-performing participant (not knowing the level of her teammate is better than knowing than she is also of low performance level).

Figure 3.7 shows the proportion of entry in each of the three tournaments where participants are broken down by gender and perforpance level (below and above

median). As can be seen on figures (a) and (b), men from the Benchmark sessions have a strategic behavior. Low-performing men enter the team tournament more often than the individual tournament so as to take advantage of the performance of a more able teammate. Indeed, they are less likely to choose the team tournament when matched with a teammate of the same (low) level as their own. As for high-performing men, almost all of them enter the individual tournament but a lot of them are repelled from the team tournament by the possibility of being dragged-down by a less able participant (since most of them are willing to enter the team tournament with a teammate of the same level). The creation of a group identity seems to have provoked a change in men's reasons for entering a tournament. In the Identity sessions, men's choice to enter a tournament does not seem to vary with their performance, and it does not seem to depend on the type of tournament (individual vs team-based) either. More precisely, men do not opt out of the tournament when it is team-based. Group membership seems to have make men willing to take the risk of being matched with a less able participant.

As for women, in the Benchmark sessions, there seems to be no link between their performance level and their decision to enter a tournament (see figures (c) and (d)). They just enter at slightly higher rates when the tournament is team-based rather than individual. On the other hand, in the Identity sessions, women act a bit more strategically, choosing to enter the individual tournament all the more that their performance is high. Furthermore, low-performing women seem to be attracted by the team tournament whether they have information about their teammate's level



(a) Entry rates of low-performing men (b) Entry rates of high-performing men

(c) Entry rates of low-performing women (d) Entry rates of high-performing women

Figure 3.7. *Entry rates for each of the 3 tournaments by gender and performance level*

or not while high-performing women choose the tournament slightly less often when it is team-based except if they know their teammate will be of the same (high) level as their own.

In order to understand what causes participants to enter a given tournament and opt out of the other one, regressions were run using the change in the decision to enter tournaments as the dependent variable. Specifically, the change in tournament entry between the individual tournament and the team tournament and between the team tournament and the team tournament with a teammate of the same level are the dependent variables of the regressions which results are reported in table 3.5.

The regressors include a Female dummy, a PerfLevel dummy which equals 1 if the subject's task 2 performance was above median and 0 otherwise [7], an Id dummy which equals 1 if the subject took part in one of the Identity sessions and 0 if she took part in a Benchmark session, an interaction term between Female and PerfLevel and an interaction term between Female, PerfLevel and Id.

Table 3.5: Ordered logit of change in decisions to enter the tournaments

Regressors	Change between IT and TT			Change between TT and TTid		
	BM	ID	All	BM	ID	All
Female	0.27	-1.46	-0.69	-1.39	0.62	-0.14
	(0.73)	*(0.03)*	*(0.17)*	*(0.10)*	*(0.96)*	*(0.77)*
PerfLevel	-0.24	1.77	0.75	0.37	-0.60	-0.19
	(0.73)	*(0.02)*	*(0.13)*	*(0.61)*	*(0.76)*	*(0.71)*
Female*PerfLevel	-2.27	1.59	-1.18	2.65	-0.87	0.38
	(0.03)	*(0.09)*	*(0.11)*	*(0.01)*	*(0.92)*	*(0.07)*
Id			0.31			-0.28
			(0.45)			*(0.49)*
Female*PerfLevel*Id			1.64			-1.51
			(0.02)			*(0.03)*
Observations	76	90	166	76	90	166

Ordered logit regressions.
P-values are in brackets.

Concerning the change of choice to enter the tournament when it goes from being individual to being team-based, the coefficient of Female*PerfLevel is negative and significant in the Benchmark sessions while it is positive and significant at the 10% level in the Identity sessions. This shows that, in the Benchmark sessions, high-performing men are more likely than others to enter the individual tournament but opt out of the team tournament, while, in the Identity sessions, high-performing men

7. I tried to include Guesswin rather than PerfLevel into the regressors but it turns out not to be significant. One reason could be that men and women of the same level may not make as confident assessment due to differences in modesty.

are less likely to exhibit this behavior in comparison to others. In the regression of the whole pool of participants, the coefficient of Female*PerfLevel*Id is positive and significant which confirms that group identity makes high-performing men less likely to shy away from team competition.

Looking at how competitive behaviors change between the standard team tournament (TT) and the team tournament with a teammate of the same level (TTid), it appears that high-performing men from the Benchmark sessions are more likely than others to favor the TTid over the TT, since Female*PerfLevel is positive and highly significant, while it is not the case in the Identity sessions. This could either come from group identity making high-performing men more willing to take the chance of being matched with a teammate of lower ability or from group identity making women fear all the more the uncertainty on their teammate's ability that their perfromance is high. The negative and significant coefficient of Female*PerfLevel*Id in the regressions concerning all participants shows that when their teammate is a fellow group member, high-performing men are less likely in comparison with other participants to refuse to enter the team tournament unless they are matched with a teammate of similar performance level.

In order to understand if these results come from men becoming less selfish or from women becoming more selfish when belonging to a social group, separate regressions were run for men and women which results are reported in table 3.6.

It appears that the results are mainly driven by high-performing men being both, less likely to enter the individual tournament and opt out from the standard team

Table 3.6: Ordered logit of change in decisions to enter the tournaments by gender

Regressors	Change between IT and TT		Change between TT and TTid	
	Men	Women	Men	Women
Id	0.92	-0.78	-1.37	0.67
	(0.24)	*(0.27)*	*(0.07)*	*(0.36)*
PerfLevel	2.64	-0.22	-2.41	0.32
	(0.00)	*(0.74)*	*(0.00)*	*(0.64)*
Id*PerfLevel	-2.44	1.58	2.72	-0.88
	(0.02)	*(0.10)*	*(0.01)*	*(0.37)*
Observations	91	75	91	75

Ordered logit regressions.
P-values are in brackets.

tournament, and less likely to only enter the competition when they know their teammate wil be of (high) level close to their own (The coefficient of Id*PerfLevel ispositive and highly significant in the regression of the change in entry between the TT and the TTid). As far as the women are concerned, one can only say that group identity makes high-performing women marginally significantly (p=0.10) more likely to enter the individual tournament but not the team tournament. However, women do not display a significantly more selfish behavior in the Identity sessions by favoring all the more the team tournament wit a teammate of the same level over the standard team tournament that their performance is high.

3.3.5. How male vs female competition affects men and women's competitive behavior

The results reported until now concern subjects who went through artificial group-identity-building activities. Two additional sessions were run using a naturally-

occuring identity: male vs female.[8] This section investigates whether knowing that one will have to compete against members of the opposite gender with someone of the same gender as teammate in the case of the team tournament has an impact on men and women's competitive behavior. Notice, however, that the scarce data available (only 20 men and 20 women took part in these gender-identity sessions) do not allow to draw definite conclusions.

3.3.5.1. Can the higher proportion of men in the Identity sessions account for the decrease in women's competitiveness?

Since the Benchmark sessions were composed of 51% of men while there were 58% of men in the Identity sessions and this could have had an impact on men and women's competitiveness, it allows to check whether, knowing one is going to have to compete against a member of the opposite gender with someone of the same gender as teammate for the team tournament, has an impact on one's decision to compete. 40 participants took part in these gender-identity sessions, 20 men and 20 women.

The first result that can be drawn from these two sessions concerns the participants' confidence in their chances to win the individual tournament. If the reason why women are less confident in their chances of winning the individual tournament in the Identity sessions than in the Benchmark sessions is because they are more likely to be opposed to a man in the Identity sessions, one would expect women

8. For these two sessions, the experimental design was the same as that of the Benchmark sessions except that participants knew that if they engaged in a tournament their opponent(s) would be of the opposite gender and their teammate, in the case of team competition, would be of the same gender as their own. Thus, participants did not take part in group-identity-building activities as they did in the Identity sessions.

to be even less confident when they know for sure their opponent will be a man. Actually, women are as confident in their chances to beat their opponent when they know it is a man than when they do not know and have a fifty-fifty chance of being opposed to either a men or a women (respectively 75% and 78% of women in the gender-identity sessions and the Benchmark sessions hold beliefs consistent with winning the individual tournament) and they are more confident than women from the Identity sessions (of which 58% hold such beliefs) who have a 58% chance of being opposed to a man, even though, not significantly so (a two-sided exact Fisher's test yields p=0.21). This would tend to invalidate the assumption that women from the Identity sessions are less confident because they are more likely to have a male opponent and they believe men to be on average better than women.

Studying women's decision to enter the individual tournament, one can also rule out the higher probability of having a male opponent as a reason for women to enter less often in the tournament in the Identity sessions than in the Benchmark sessions. Indeed, if such was the case, women's propensity to enter the individual tournament would drop sharply in the gender-identity sessions where they know for sure their opponent will be a man, which does not happen. Women from the gender-identity sessions enter the individual tournament at a slightly higher rate than women in the Identity sessions (40% vs 32%) and a little bit more often than their counterparts from the Benchmark sessions of which 51% prefer the individual tournament to the piece rate. Neither of these differences reaches significance.

It therefore seems that the gender of her opponent is not a main driver of women's

decision whether to enter the individual tournament. The reason for which women shy away from competition even more when they are part of a social group must then be, either that the identity-building-activities failed at instilling them a sense of group membership, or that belonging to a group does not make women more willing to compete against outgroups but, if anything, makes them more peaceable towards others.

3.3.5.2. Men and women's willingness to compete as a team in a male vs female competition

The following results are tentative as only two gender-identity sessions have been run so far. Studying the pattern of tournament-entry decisions in the gender-identity sessions, it seems that men exhibit the same competitive behavior as in the Benchmark sessions, entering massively in the individual tournament (74%) but a lot of them dropping out of the team tournament (42%) unless they know they will be matched with a teammate of level close to their own (79%). Looking closer at this behavior, it appears that high-performing men (with an above-median Task 2 performance) are the more prone to opt out of the team tournament when they ignore the ability of their teammate. It therefore seems that men do not display the same solidarity towards other unknown men than they do towards fellow group members of unknown gender. Namely, they are willing to lower their chances of winning the tournament when matched with a member of their social group but are reluctant to do so with a male teammate they share nothing else with. Furthermore, men react

in the same way whether they ignore the gender of their opponents (as it is the case in the Benchmark sessions) or they know they are female.

As for women, their decision to compete does not depend much on the modality of the competition (respectively 40%, 35% and 40% of women enter the individual tournament, team tournament and team tournament with a teammate of the same level). Studying separately low-performing and high-performing women, it seems that, while low-performing women enter the team tournament a bit more when they do not know the ability of their teammate than when they know they will be matched with a woman of the same (low) level as their own, lots of high-performing women enter the team tournament only when they know their teammate will be of (high) ability like themselves. As this was not the case in the Benchmark sessions, it could mean that women are less prone to solidarity towards another woman than towards a random teammate.

3.4. Discussion

The creation of a group identity has led to clear changes in men's behavior who have become less selfish and more likely to take actions which benefit the members of their group. Women are even less competitive when they went through the group-identity-building activities and, if anything, act more selfishly.

High-performing men become more prone to help a possibly less efficient teammate get higher payoffs if he or she is a fellow group member, while low-performing men are less likely to take advantage of a probably more efficient teammate when

they belong to the same social group. This is in line with the idea that group identity shifts behaviors from individual interest towards the interest of the group. Eckel & Grossman (2005) found that a strong induced identity succeeds in reducing individual shirking behaviors and free-riding in public goods games. Wit & Wilke (1992)'s results suggest that group categorization elicits more cooperation than individual categorization. The perception of sharing a common fate leads to more self-restraint in a common-ressource dilemma (Brewer & Kramer, 1986). Furthermore, Tajfel & Turner (1986) showed that individuals who perceive themselves as members of a social group want to maximize the inter-group outcome difference which may explain why men become more willing to enter a team competition against an outgroup team.

Women's reaction to the creation of a social identity is more surprising. The first noticeable fact is that the group identity seems to have decreased low-performing women's willingness to enter competitive environments. Another change in women's behavior caused by the creation of a group identity is that low-performing women tend to less hesitate to take advantage of a more efficient teammate when they belong to her group. This last result is nevertheless only a tendency as it does not reach statistical significance. In any case, women do not experience the same shift in their behavior towards acting more in the interest of their group as men do. One can only venture some reasons why this is the case. Firstly, it may be the case that the attempt of creating a group identity did not succeed for women as well as it did for men. As a result, women may not perceive themselves as belonging to their group or

they may not feel as included as men do. Some past experimental findings back up this interpretation of women's behavior. Cadsby & Maynes (1998) found that their attempt to create a group identity decreased women's contributions in early rounds of the public good game. They blame it on the fact that the activity meant to build a group identity failed to do so for women as they did not seem to have enjoyed it. In the same vein, Brown-Kruse & Hummels (1993) found an effect of the creation of a group identity for men who contribute more to the public good when belonging to a group, but none for women. Secondly, women may perceive themselves as members of their group but not react to this group identity in the same way as men do. For instance, while low-performing men feel less entitled to take advantage of a probably more able participant if he is a fellow group member rather than a total stranger, women may, on the contrary, be more comfortable dragging down a member of their social group than a random participant. However, if this second interpretation held, high-performing women should be more willing to be matched with a probably less efficient teammate if he or she belongs to her group rather than if he or she is a total stranger, which is not the case. Finally, as group identity may increase the feeling of accountability towards fellow group members, it could be the case that women react by shying away even more from competition so as not to interfere with their group members' outcomes and utility in general (as they may even perceive a setback in the individual tournament as hurting their group).

Regarding the consequences in terms of efficiency, group identity allows to get high-performing men to self-select into the team competition even when they do

not know that their teammate is also of high ability. This could lead to positive externalities as, in time, one could improve her own performance when matched with a more able teammate. In opposition to men's behavior, women's tendency to shy away even more from competition when belonging to a group and, potentially, acting less as team players than when surrounded by random people, has a negative impact on both parity and efficiency. The important point is whether women's reaction to group identity is an artefact of the lab or whether women would act in the same way in real life. I would tend to think that women did not enjoy the group-identity-building activities participants had to go through as much as men but more work needs to be done to analyze the discussions through the instant message system. A first result is that men intervened more often than women through this system (a two-sided Mann-Whitney test yields p=0.06) but it would be worthwhile to analyze the type of intervention men and women made (where men more likely to come up first with a name for the group or to make jokes?).

3.5. Conclusion

Recent experimental research papers are interested in how social identity affects individual behavior. Most existing results focus on self-other allocation games (Chen & Li, 2009), social dilemmas or public-goods games (Charness *et al.*, 2007, Sutter, 2009, Eckel & Grossman, 2005). This chapter studies the effect of an artificially created group identity on participants' willingness to compete either alone or as part of a team. Participants were randomly separated into two groups and could

use a instant message system to communicate with their fellow group members. Using this communication system, they had to find a name for their group and then to answer a four-question quizz which was meant to build a sense of group membership.

The main result is that, while team competition was successful in eliminating the gender gap in tournament entry in the Benchmark sessions, it is no longer the case in the Identity sessions. The reason lies in men's behavior and, more precisely, in high-performing men's behavior who opt out of team competition in the Benchmark sessions because they dread being matched with a less able teammate but overcome this fear when their teammate is a fellow group member.

This result suggests that high-performing men are more comfortable working in teams with teammates they perceive as belonging to the same circles as they do. Indeed, Montgomery (1991) finds that 50 percent of workers employed at the time of their study got their job through friends or relatives. This could also help explain why alumni from a given university often try to hire graduates from the same university. According to Rebick (2000), more than half of all hires on the japanese job market can be attributed to employers' persistence to hire graduates from the same universities.

Another finding of this chapter is that low-performing women become less willing to compete and, if anything, less socially-oriented when one tried to instill them a sense of group membership. As for high-performing women, they do not display any sign of "group spirit" either. Whether this is because the group identity building

activities failed to make women feel included in their group or because women are not as prone as men to cliquish behaviors remains unclear.

Future research may study how the nature of social groups affects one's willingness to compete as part of a team as Solow & Kirkwood (2002) show that contributions to public goods are sensible to this issue. It could also be interesting to find out how knowing the gender of one's other group members influences competitive behaviors.

Instructions

Benchmark sessions

The experiment is composed of 8 tasks. Before each task, you will be carefully explained what the task is about and have the opportunity to ask as many questions as you need. Please remember that you are not allowed to communicate in any way with one another. At the end of the experiment two of the eight tasks you will have completed will be randomly chosen to determine your payoffs.

Task 1. Piece Rate: In task 1, you will have 3 minutes to solve as many additions of 5 two-digits numbers as you can. You are allowed to use the scratch paper you have been given. If Task 1 is one of the two tasks randomly chosen for payment, you will receive 50 cents per addition correctly solved. At the end of Task 1, a screen will indicate you how many additions you solved correctly.

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Task 2. Individual Tournament: You will have 3 minutes to solve as many additions of 5 two-digits numbers as you can. If Task 2 is chosen for payment, you will receive 1 euro per correct answer if you solved more additions than a randomly chosen opponent present in the room, otherwise you will receive nothing. You will earn 50 cents per addition correctly solved in case of a tie.

At the end of Task 2, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament only at the end of the experiment.

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Task 3. Choice between Piece Rate and Individual Tournament: Before performing your 3 minutes of additions, you will have to choose whether you want to be paid according to the Piece Rate (50 cents per correct answer) or the Individual Tournament compensation scheme.

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during Task 3.

If you select the tournament, you will receive 1 euro per correct answer if your Task 3 performance exceeds the Task 2 performance of a randomly chosen opponent, otherwise you will receive nothing. You will earn 50 cents per addition correctly solved during Task 3 in case of a tie.

At the end of Task 3, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment.

NEXT PAGE

Task 3 bis. Choice between *submitting* Task 1 performance to Piece Rate or Individual Tournament: No additions to do here, the performance which will determine your payoffs is your Task 1 performance.

If you choose to submit your Task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your Task 1 performance to the individual tournament, you will receive 1 euro per addition correctly solved in Task 1 if you solved more

additions in Task 1 than your randomly chosen opponent, otherwise you will receive nothing. You will earn 50 cents per addition correctly solved during Task 1 in case of a tie.

You will know whether you won your tournament, if you choose to submit your Task 1 performance to the tournament, only at the end of the experiment.

NEXT PAGE

Task 4. Choice between Piece Rate and Team Tournament: You have to choose whether they want to be paid according to the Piece Rate or the Team Tournament. The Team Tournament is a two to two competition.

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during Task 4.

If you choose the Team Tournament, two opponents will be randomly drawn among the other participants present in the room. One teammate will be randomly drawn among the participants who chose the team tournament. If the number of additions solved by your team during Task 4 exceeds the number of additions solved by the opposing team during Task 2, each teammate of your team will receive 1 euro times the average score of the team. Otherwise, you will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 4 in case of a tie.

At the end of Task 4, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment. You will not know either your teammate's

performance until the end of the experiment.

NEXT PAGE

Task 4 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament: No additions to do here, the performance which will determine your payoff is your Task 1 performance.

If you choose to submit your Task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your Task 1 performance to the Team Tournament, two opponents are randomly drawn among the other participants present in the room. One teammate is randomly drawn among the participants who chose to submit to the Team Tournament. If the number of additions solved by your team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, you and your teammate will each receive 1 euro times the average score of the team. Otherwise, you will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 1 in case of a tie.

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Task 5. Choice between Piece Rate and Team Tournament with a teammate of the same level (TTid henceforth):

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during task 5.

If you choose the Team Tournament with a teammate of the same level, two opponents will be randomly drawn among the other participants present in the room.

Your teammate will be the participant, who chose the team tournament with a teammate of the same level, whose Task 2 performance was the closest to your own Task 2 performance. If the number of additions solved by your team during Task 5 exceeds the number of additions solved by the opposing team during Task 2, you and your teammate will each receive 1 euro times the average Task 5 score of your team. Otherwise, you and your teammate will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 5 in case of a tie.

At the end of Task 5, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment. You will not know either your teammate's performance until the end of the experiment.

NEXT PAGE

Task 5 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament with a teammate of the same level: No additions to do here, the performance which will determine your payoff is your Task 1 performance. If you choose to submit your task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your task 1 performance to the team tournament with a teammate of the same level, two opponents will be randomly drawn from among the other participants present in the room. Your teammate will be the participant, who chose to submit to the team tournament with a teammate of the same level,

whose Task 2 performance was the closest to your own Task 2 performance. If the number of additions solved by your team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, you and your teammate will each receive 1 euro times the average score of their team. Otherwise, you and your teammate will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 1 in case of a tie.

NEXT PAGE

Belief-assessment Questions The experiment is now almost over. You just have to answer a few questions about the experiment. For each correct guess, you will earn 1 additional euro.

At Task 4, whether you chose to enter the team tournament or not, two opponents were randomly drawn among the other participants present in the room. One teammate was randomly drawn among the participants who chose the Team Tournament. Knowing that your own Task 2 performance will be recalled to you on the next screen, please guess the task 2 performances of your 2 opponents and your teammate. Also guess the Task 2 performance of the average participant present in the room.

Identity sessions

You have been randomly split into two groups of equal size by the computer. Nevertheless, you cannot know who in this room belongs and does not belong to your group and it is important that it remains this way. There will be three phases

to this experiment. I will explain clearly what each phase is about before it begins and you will have the opportunity to ask as many clarifying questions as you need.

First phase

In this first phase, all you have to do is find a name for your group. In order to do so, you will be able to use an instant message system to communicate whithin your group. Of course, you will be unable to communicate with members of the other group. You will have 2 minutes to discuss what name you want to give to your group. *Remember that it is important that you do not find out who is and is not in your group, so please try not to provide information on yourself that could give you away.* At the end of the three minutes, the message system's window will close and a new screen will appear with a space for you to enter the name you chose. If all members in your group failed to agree on a name, I will pick the name chosen by a majority of members. I will then publicly announce the name chosen by both groups.

Second phase

In the second phase, you have to answer a four-question quizz with your group. For each question, you have two minutes to discuss through the instant message system what you think is the good answer among the four possibilities. At the end of the two minutes, you have to click on the possibility which you think is the right answer. The answer validated for your whole group is the one chosen by a majority of members. You will earn 1 euro per correct answer validated for your group. Please

note that if say, the correct answer is answer A and you selected answer A but all your fellow group members chose answer B, you will earn nothing for this question since the answer validated for you and your all group is (incorrect) answer B. You will know the correct answers and how much you made during this second phase only at the end of the experiment.

Third phase

The third phase is composed of 8 tasks. Before each task, you will be carefully explained what the task is about and have the opportunity to ask as many questions as you need. Please remember that you are not allowed to communicate in any way with one another. At the end of the experiment two of the eight tasks you will have completed will be randomly chosen to determine your payoffs.

Task 1. Piece Rate: In task 1, you will have 3 minutes to solve as many additions of 5 two-digits numbers as you can. You are allowed to use the scratch paper you have been given. If Task 1 is one of the two tasks randomly chosen for payment, you will receive 50 cents per addition correctly solved. At the end of Task 1, a screen will indicate you how many additions you solved correctly.

NEXT PAGE

Task 2. Individual Tournament: You will have 3 minutes to solve as many additions of 5 two-digits numbers as you can. If Task 2 is chosen for payment, you will receive 1 euro per correct answer if you solved more additions than your opponent randomly chosen among the members of the other group, otherwise you

will receive nothing. You will earn 50 cents per addition correctly solved in case of a tie.

At the end of Task 2, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament only at the end of the experiment. At the end of the experiment, you will find out how many members of your group won their tournament.

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Task 3. Choice between Piece Rate and Individual Tournament: Before performing your 3 minutes of additions, you will have to choose whether you want to be paid according to the Piece Rate (50 cents per correct answer) or the Individual Tournament compensation scheme.

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during Task 3.

If you select the tournament, you will receive 1 euro per correct answer if your Task 3 performance exceeds the Task 2 performance of an opponent randomly chosen among the members of the other group, otherwise you will receive nothing. You will earn 50 cents per addition correctly solved during Task 3 in case of a tie.

At the end of Task 3, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment. At the end of the experiment, you will find out how many members of your group and of the other group chose the tournament and how many won it.

NEXT PAGE

Task 3 bis. Choice between *submitting* Task 1 performance to Piece Rate or Individual Tournament: No additions to do here, the performance which will determine your payoffs is your Task 1 performance.

If you choose to submit your Task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your Task 1 performance to the individual tournament, you will receive 1 euro per addition correctly solved in Task 1 if you solved more additions in Task 1 than your opponent randomly chosen among the members of the other group, otherwise you will receive nothing. You will earn 50 cents per addition correctly solved during Task 1 in case of a tie.

You will know whether you won your tournament, if you choose to submit your Task 1 performance to the tournament, only at the end of the experiment. At the end of the experiment, you will find out how many members of your group and of the other group chose the tournament and how many won it.

NEXT PAGE

Task 4. Choice between Piece Rate and Team Tournament: You have to choose whether they want to be paid according to the Piece Rate or the Team Tournament. The Team Tournament is a two to two competition.

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during Task 4.

If you choose the Team Tournament, two opponents will be randomly drawn among

the members of the other group. One teammate will be randomly drawn among the members of your group who chose the team tournament. If the number of additions solved by your team during Task 4 exceeds the number of additions solved by the opposing team during Task 2, each teammate of your team will receive 1 euro times the average score of the team. Otherwise, you will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 4 in case of a tie.

At the end of Task 4, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment. You will not know either your teammate's performance until the end of the experiment.

If you choose the tournament, you will only know whether you won it at the end of the experiment. At the end of the experiment, you will find out how many members of your group and of the other group chose the tournament and how many won it.

NEXT PAGE

Task 4 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament: No additions to do here, the performance which will determine your payoff is your Task 1 performance.

If you choose to submit your Task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your Task 1 performance to the Team Tournament, two opponents are randomly drawn among the members of the other group. One team-

mate is randomly drawn among the members of your group who chose to submit to the Team Tournament. If the number of additions solved by your team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, you and your teammate will each receive 1 euro times the average score of the team. Otherwise, you will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 1 in case of a tie.

If you choose the tournament, you will only know whether you won it at the end of the experiment. At the end of the experiment, you will find out how many members of your group and of the other group chose the tournament and how many won it.

NEXT PAGE

Task 5. Choice between Piece Rate and Team Tournament with a teammate of the same level (TTid henceforth):

If you choose the Piece Rate, you will receive 50 cents per addition correctly solved during task 5.

If you choose the Team Tournament with a teammate of the same level, two opponents will be randomly drawn among the members of the other group. Your teammate will be the member of your group, who chose the team tournament with a teammate of the same level, whose Task 2 performance was the closest to your own Task 2 performance. If the number of additions solved by your team during Task 5 exceeds the number of additions solved by the opposing team during Task 2, you and your teammate will each receive 1 euro times the average Task 5 score of your team. Otherwise, you and your teammate will receive nothing. You and your

teammate will each earn 50 cents times the average score of the team during Task 5 in case of a tie.

At the end of Task 5, a screen will indicate how many additions you solved correctly but you will know whether you won your tournament, if you choose to engage in it, only at the end of the experiment. You will not know either your teammate's performance until the end of the experiment.

If you choose the tournament, you will only know whether you won it at the end of the experiment. At the end of the experiment, you will find out how many members of your group and of the other group chose the tournament and how many won it.

NEXT PAGE

Task 5 bis. Choice between *submitting* Task 1 performance to Piece Rate or Team Tournament with a teammate of the same level: No additions to do here, the performance which will determine your payoff is your Task 1 performance.

If you choose to submit your task 1 performance to the Piece Rate, you will receive 50 cents times your Task 1 performance.

If you choose to submit your task 1 performance to the team tournament with a teammate of the same level, two opponents will be randomly drawn from among the members of the other group. Your teammate will be the member of your group, who chose to submit to the team tournament with a teammate of the same level, whose Task 2 performance was the closest to your own Task 2 performance. If the number of additions solved by your team during Task 1 exceeds the number of additions solved by the opposing team during Task 1, you and your teammate

will each receive 1 euro times the average score of their team. Otherwise, you and your teammate will receive nothing. You and your teammate will each earn 50 cents times the average score of the team during Task 1 in case of a tie.
If you choose the tournament, you will only know whether you won it at the end of the experiment. At the end of the experiment, you will find out how many members of your group and of the other group chose the tournament and how many won it.

NEXT PAGE

Belief-assessment Questions The experiment is now almost over. You just have to answer a few questions about the experiment. For each correct guess, you will earn 1 additional euro.

At Task 4, whether you chose to enter the team tournament or not, two members of the other group were randomly drawn among the other participants present in the room. One teammate was randomly drawn among the members of your own group who chose the Team Tournament. Knowing that your own Task 2 performance will be recalled to you on the next screen, please guess the task 2 performances of your 2 opponents and your teammate. Also guess the Task 2 performance of a randomly chosen member of your group and of a randomly chosen member of the other group.

General Conclusion

This dissertation contributes to a literature interested in understanding why women are under-represented in high-profile jobs and, more generally, top-level social positions in the society.

In a first chapter, we tackled a specific kind of self-confidence, calibration, which corresponds to one's confidence in his own knowledge. The calibration literature typically finds that people tend to be overconfident when asked to provide confidence intervals for general knowledge questions. The average subject has a lot less than 90% of correct answers fall into the 90% confidence intervals he provided for a set of questions and is therefore considered miscalibrated. Experimental results suggest miscalibration has economic consequences as miscalibrated agents tend to suffer losses (Biais *et al.*, 2005, Bonnefon *et al.*, 2005). The first chapter proposed a training during which a maximum of incentives where implemented in order to reduce miscalibration.

While, in line with the literature, our subjects were found to be overconfident when asked to provide 50% and 90% confidence intervals, they exhibited under-confidence in their knowledge at the 10% level as more than 10% of correct answers

belonged to the 10% intervals provided. The incentives we proposed only had a slight effect on participants' miscalibration. It somewhat reduced overconfident miscalibration but only for men. This gender effect, as small as it may be, led to a broader reflection on gender differences in preferences and response to incentives and layed the ground for chapters 2 and 3.

In the second chapter, I studied the way team competition affects men and women's willingness to compete. The main result is that team competition succeeded in removing the gender gap in tournament entry which was large and highly significant when participants had to choose whether to enter the individual competition. The elimination of the gender gap wass not due to women entering the competition more often when it is team based (which was the case but not significantly so) but, unexpectedly, from men shying away from the team tournament while they massively chose to enter the individual tournament.

The experimental design allowed to disentangle the different explanations for this result. Participants had to go through several tasks each of which corresponded to a choice between two remuneration schemes. The variations in the remuneration schemes available enabled one to infer from the choices the reasons behind the changes in competitive behavior when the competition went from being individual to being team-based. In particular, after having chosen whether they wanted to be paid according to a piece rate or a team tournament remuneration scheme, participants had to make a subsequent choice between a piece rate and a team tournament where they knew their teammate would be of level close to their own while they had

no information whatsoever on their teammate's ability in the previous choice.

The results indicated that the disappearance of the gender gap was in great part driven by high-performing men opting out of the team tournament because they do not want to take the chance of losing the tournament as a result of being matched with a low-performing teammate. Indeed, high-performing men were perfectly willing to enter the team tournament when they knew they would be matched with someone of level close to their own. Consequently, team competition did not harm the quality of the pool of entrants, provided teams were formed of teammates of about the same level.

The third chapter was built on the second one. It was meant to investigate the impact of group identity on men and women's competitive behavior. Participants were randomly divided into two groups and went through group-identity-building activities involving communication through an instant message system with the other members of their group. Apart from that, the experimental design was built on that of the second chapter: participants had to go through the same tasks but, whenever they chose to enter a tournament, their opponent(s) belonged to the other group and, in the case of team competition, their teammate was a fellow group member.

The main finding is that high-performing men were no longer reluctant to enter the team tournament without knowing the ability of their teammate when he or she was a fellow group member wich is in line with the idea that group membership shifts behaviors towards those more in favor of the whole group. If anything, group identity made women more likely to shy away from competition and a bit more

selfish.

It therefore appears that men are only willing to enter a team competition if they know their teammate is at least of ability equal to their own or if they share a common social identity. As for women, they are only slightly more likely to enter a competition when it is team-based and, if anything, knowing that their teammate is a fellow goup member makes them even more reluctant to self-select into the competition.

The results that emerged from this dissertation and especially from the two last chapters leave many questions open for future research to investigate. The notion of team used in chapters 2 and 3 was a minimal one. For instance, participants did not know the gender of their teammate and opponents. Future research may study how knowing one's teammate and opponents' gender would affect one's willingness to compete. Furthermore, in chapters 2 and 3, participants had to decide at the same time whether they wanted to be part of a team and whether they wanted to enter a team competition. It could be interesting to find out how members of a pre-existing team jointly decide whether to compete. For instance, are men more likely to succeed in talking a female teammate into entering a competition?

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