Three essays on regulation and taxation of stocks and derivatives

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Contents

Introduction générale

La taxe sur les transactions financières (TTF) est un des thèmes les plus discutés de la réglementation des marchés financiers. Malgré qu'elle soit considérée comme un outil difficile à mettre en place, plus d'une trentaine de pays européen (Finlande, France, Italie) et non-européen (la Corée du sud, Hong Kong, Taiwan) taxent les transactions financières. Les partisans affirment que la taxe freinerait les activités spéculatives, ce qui renforcerait la stabilité des marchés financiers (Summers and Summers, 1989; Stiglitz, 1989). Les opposants soutiennent qu'une TTF non seulement nuirait à la qualité des marchés financiers, mais pèserait aussi inutilement sur l'économie en déséquilibrant l'allocation du capital (Matheson, 2011; Habermeier and Kirilenko, 2003). Bien que les travaux de recherche théoriques et empiriques soient abondants, de nombreuses questions persistent. Les nouvelles technologies (par exemple, le trading à haute fréquence (HFT)) ainsi que le routage intelligent des ordres et les régimes de tarification innovants tels que la tarification "maker-taker" ont ajouté encore plus de complexité au marché. Dans ce contexte et compte tenu des résultats contradictoires des travaux de recherche, et des futurs projets potentiels de TTF dans de nombreux pays, il est indispensable que la recherche fournisse des orientations et recommandations aux régulateurs, aux praticiens et aux universitaires.

Conscients que le débat n'a pas abouti à un consensus, et que les risques de crise financière demeurent, nous souhaitons contribuer à l'évaluation des politiques de taxation et de régulation des marchés financiers.

Pour se faire, nous commencerons par une discussion des origines et de la littérature de la TFF, ensuite discuterons des motivations et objectifs de cette thèse, avant de conclure en résumant le but, la méthodologie et les résultats de chaque chapitre.

Taxe sur les transactions financières : Définition et origines

Définition de la TTF

Une TTF est simplement une taxe imposée sur une transaction financière, généralement l'achat et/ou la vente de titres. La taxe peut être imposée à l'acheteur, au vendeur, ou aux deux, et est généralement une taxe ad valorem, c'est-à-dire un pourcentage de la valeur marchande du titre qui est négocié. Les taux de la TTF varient généralement de 0,1% à 0,5%. Dans le cas des opérations sur produits dérivés - la base taxable est difficile à identifier- la taxe peut être prélevée sur la valeur de la prime ou sur la valeur nominal du produit dérivé. Souvent, la taxe n'est prélevée que lors de la revente d'un actif, et non lors de son émission initiale. La charge ultime de l'impôt sur un titre particulier dépend de la fréquence des transactions. Les actifs liquides comme les obligations d'état ou les actions peuvent être taxés plusieurs fois au cours d'une année, alors que les actifs relativement peu liquides qui ne sont pas renouvelés fréquemment sont rarement soumis à la taxe.

Matheson (2011) propose un classement des différents types de taxes. Les taxes sur les acquisitions de titres (STT) concernent l'émission et/ou la négociation de titres financiers et incluent potentiellement les actions, les dettes et les produits dérivés connexes. Les taxes sur les opérations de change (également connues sous le nom de taxe Tobin) concernent les opérations de change et les produits dérivés connexes. Les taxes sur les transactions bancaires ou les taxes sur les opérations bancaires, que l'on trouve couramment dans les pays d'Amérique latine et d'Asie, s'appliquent aux dépôts et aux retraits des comptes bancaires. En outre, certains pays taxent les primes d'assurance, les transactions immobilières ou les ajouts au capital des entreprises.

Origine de la taxe Tobin

Les projets de la TTF surgissent souvent en réponse aux crises (Wahl, 2015). L'idée d'imposer une taxe a été proposée en premier par (Keynes, 1937) à la suite de la Grande Dépression de 1929. Il considère que le marché est surpeuplé par des amateurs faisant varier les prix sans aucune raison valable. Cette situation pose, selon lui, un problème majeur : il devient plus rentable pour les acteurs du marché plus rationnels d'essayer de prévoir ces mouvements de prix à court terme plutôt que de s'intéresser à la valeur de long terme des titres. Les marchés se tournent alors vers la "spéculation" plutôt que vers "l'entreprise". Selon Keynes, en imposant la TTF, la spéculation à

court terme serait pénalisée et les investisseurs seraient plus intéressés par les performances de long terme des entreprises dans lesquelles ils investissent. Par conséquent, la taxe réduirait la volatilité en limitant les activités spéculatives.

En 1972, l'économiste James Tobin, lors des conférences *Janeway* à Princeton, a proposé l'introduction d'une taxe sur le taux de change. Sa proposition a été publiée en 1974 sous le titre *The New Economics One Decade Older* suite à la fin des accords de Bretton Woods, où la valeur des différentes monnaies pouvait désormais flotter librement les unes par rapport aux autre, créant ainsi de la volatilité sur le marché des changes. Tobin (1978), dans son discours en tant que président du *Eastern Economic Association*, a donc proposé deux solutions : la première est de créer une monnaie unique, et la seconde est de "jeter du sable dans les rouages des marchés financiers" en taxant toute transaction de change au comptant d'une monnaie à une autre. Le but de cette taxe est d'atténuer la spéculation et se faisant de réduire la volatilité "excessive" sur les marchés. Frankel (1996) souligne que cette taxe dite Tobin pénaliserait les investissements à court terme, et ceci d'autant plus que l'horizon est court.

Pour Friedman (1953), la spéculation ne peut pas être considérée comme déstabilisatrice en général car, si elle l'était, les acteurs impliqués perdraient de l'argent. Ce courant de la littérature soutient donc que les opportunités de spéculation se produisent lorsque le marché est inefficace, et que les opérations d'arbitrage sur des profits potentiels inexploités sont utiles pour équilibrer les marchés et stabiliser les prix, en les ramenant à leurs valeurs fondamentales. Friedman (1953) soutient aussi que la taxe réduit l'efficience du marché et entraînent des coûts en termes de bien-être sociale. Cependant, selon Stiglitz (1989), la position de Friedman repose sur un ensemble d'hypothèses du fonctionnement du marché qui pourraient se révéler invalides. En effet, les marchés ne sont pas nécessairement efficients lorsqu'il y a des externalités ou des asymétries d'information Stiglitz (1989). Son raisonnement est le suivant : la qualité d'un marché financier, à savoir, son aptitude à financer les entreprises, à répartir le capital et partager les risques efficacement, repose sur ses acteurs, qui peuvent être très hétérogènes. Par conséquent, rien ne permet de supposer que tous ces acteurs constituent un écosystème qui optimise la qualité du marché. Stiglitz considère que trop d'investisseurs achètent et vendent des titres sans raison valable, et surtout sans disposer d'informations précises sur les entreprises sous-jacentes. En agissant ainsi, les prix deviennent plus volatils et moins informatifs, ce qui nuit à la qualité du marché. Plus simplement, ces investisseurs exercent une externalité négative et une TTF peut être considérée comme une taxe "pigouvienne" visant à corriger cette externalité.

Renouveau de la TTF

La proposition de Tobin de taxer les marchés financiers est tombée dans l'oubli avant d'être relancée au lendemain de la crise financière de 2008. Afin de réguler les marchés financiers, et aussi participer au remboursement de la dette publique, la taxation du secteur financier est devenue un sujet de débat très populaire parmi les économistes et politiciens. A cet égard, plusieurs pays européens et non européens ont proposé et pour certains déjà instauré des taxes sur les transactions financières. Par exemple, aux Etats-Unis, le gouvernement a proposé en 2012, une taxation de 0.02 pour cent du montant notionnel des transactions sur les futures. En Europe, la France et l'Italie ont mis en place une TTF à des taux respectifs de 0.3 et 0.2 pour cent depuis 2012 et 2013, respectivement. Ces taxes sont imposées sur les instruments "cash" à l'exclusion des produits dérivés. Elles ne s'appliquent pas aux transactions intra-journalières.

Ces projets de TTF montre que l'idée a gagnée en popularité en tant qu'instrument permettant de réduire la spéculation, de stabiliser les marchés financiers et de collecter des revenus. Parmi ses effets escomptés figurent une diminution de la volatilité et une augmentation de l'efficience du marché, dans la mesure ou les spéculateurs sont contraints de réduire la fréquence de leurs transactions. Dans ce contexte, la présente thèse vise à contribuer à ce débat en évaluant empiriquement, si une taxe ou toute hausse du coût sur les transactions financières freine l'activité du trading et rend les marchés financiers plus stables ? Ou si elle nuit à la liquidité du marché et à la découverte des prix, rendant ainsi les marchés encore plus volatils ? Dans la section suivante, nous présentons brièvement les évolutions des différentes hypothèses concernant le fonctionnement du marché financier avant de présenter plus en détail la littérature théorique et empirique concernant la TTF.

Revue de littérature de la TTF

Les modèles traditionnels des marchés financiers supposent que les anticipations des agents sont rationnelles (c'est-à-dire que les agents ne font pas d'erreurs systématiques puisqu'ils se basent sur des prévisions parfaitement cohérentes avec la réalité). Toutefois, ces modèles n'expliquent pas bon nombre des caractéristiques observées sur les marchés financiers, telles que l'excès de liquidité et de volatilité excessive ainsi et le phénomène de clustering de la volatilité (c'est-à-dire "les grandes variations (de la série) tendent à être suivies par de grandes variations, et les petites variations tendent à être suivies par de petites variations" (Mandelbrot, 1963)). Afin de prendre en compte ces facteurs, une nouvelle génération de modèles théoriques a exploré la microstructure des marchés

financiers. Ces modèles supposent que les acteurs du marché ne sont pas parfaitement rationnels. Ils supposent également qu'il existe différents types d'acteurs sur le marché. C'est pourquoi ils sont connus sous le nom de modèles à agents hétérogènes.

Modèles à agents hétérogènes

Les modèles à agents hétérogènes partent de l'hypothèse que les traders sont différents les uns des autres, et qu'ils sont limités dans leur rationalité. Les agents ne disposent pas de toutes les informations car : i) leur collecte est très coûteuse, et ii) il existe une incertitude majeure quant aux fondamentaux (Keynes, 1937). En conséquence, ils utilisent une série de règles générales pour définir leurs stratégies.

Ces modèles considèrent l'existence d'au moins deux types de traders : les "fondamentalistes", qui fondent leurs anticipations sur les prix futurs des actifs et leurs stratégies de trading sur les fondamentaux du marché et les facteurs économiques (tels que les dividendes, les bénéfices, la croissance macroéconomique, les taux de change, etc.), et les "chartistes" qui fondent leurs anticipations et leurs stratégies de trading sur les trajectoires de prix observées par le passé (Schulmeister, 2009). Dans un tel marché, la volatilité est déterminée par la part des traders qui sont des chartistes (qui augmentent la volatilité) par rapport à la part des fondamentalistes (qui la réduisent). Les modèles à agents hétérogènes permettent aussi de résoudre l'énigme des déterminants du taux de change, c'est-à-dire la déconnexion du taux de change de ses fondamentaux sous-jacents (Damette, 2016).

Modèles à intelligence nulle

Une autre approche afin de modéliser le comportement des marchés financiers consiste à utiliser des modèles à *intelligence nulle* (Zero Intelligence Model) - appelés ainsi parce qu'ils supposent que les transactions des opérateurs du marché, dans l'ensemble, sont la résultante de différentes trajectoires stochastiques plutôt que de comportements d'optimisation. Seules les institutions financières disposent d'un comportement d'optimisation. L'idée qui sous-tend cette approche est que la modélisation du comportement à l'aide d'agents à intelligence nulle permet d'identifier l'impact net sur le marché des choix stratégiques des institutions financières. De plus, il se pourrait que ces institutions financières façonnent le comportement des agents à un point tel que certaines caractéristiques de leur comportement dépendent davantage de la structure de ces institutions que d'une quelconque rationalité de leur part.

Modèles de la théorie des jeux

Il est également possible d'utiliser la théorie des jeux pour évaluer l'impact de la TTF sur la

volatilité. Par exemple, le Grand Canonical Minority Game model a également été utilisé pour analyser l'effet de l'imposition d'une taxe Tobin sur le marché des changes. Il s'agit d'une représentation stylisée des marchés financiers, qui sont décrits comme une écologie de différents types d'agents, de spéculateurs et de traders institutionnels, interagissant dans une *chaîne alimentaire de l'information* (Bianconi et al., 2009). Comme dans les modèles précédents, il modélise les stratégies en place entre les traders institutionnels et les spéculateurs. Ce dernier groupe est supposé être responsable à la fois de la volatilité excessive et de l'efficience du marché.

Les traders institutionnels commercent indépendamment de l'existence d'une taxe sur le marché. Quant aux spéculateurs, ils ne négocient que si le bénéfice perçu sur le marché dépasse un seuil donné. Ils tiennent compte du succès de leurs stratégies précédentes et les adaptent en conséquence. L'objectif principal de chaque agent est d'être en minorité, c'est-à-dire de placer une offre qui a le signe opposé de l'offre globale de tous les agents.

Les expériences de laboratoire

En étroite relation avec les courants théoriques ci-dessus, il existe une littérature émergente qui tente de tester ces théories directement, en construisant des expériences en laboratoire ou des simulations de marchés. Les travaux de Noussair et al. (1998) en sont un bon exemple. Ils utilisent un modèle continu de double enchère pour explorer l'impact d'une TTF sur l'efficience du marché et le volume des transactions. Ils montrent que, malgré l'imposition d'une petite taxe fixe sur les transactions, la tendance des prix est toujours de se rapprocher de leur niveau d'équilibre, avec toutefois une réduction de l'efficience du marché et du volume des échanges.

Revue de la littérature théorique

Summers and Summers (1989) soulèvent la question de la faisabilité et de la pertinence de l'introduction d'une STT. La faisabilité de la taxe est considérée comme incontestable, car elle a déjà été mise en œuvre au Japon et au Royaume-Uni. En ce qui concerne la pertinence, ils concluent que la STT permettrait de libérer des capitaux utilisés pour la spéculation, ce qui serait plus utile à d'autres secteurs d'activité. Cet effet compenserait les coûts de la diminution de la liquidité sur le marché boursier. Les résultats sont dans la lignée de Stiglitz (1989) qui soutient qu'une STT ne nuit pas au fonctionnement d'un marché financier si la volatilité n'augmente pas. En effet, il souligne en outre que la volatilité diminuerait et que les spreads relatifs ne se creuseraient pas systématiquement.

Il prédit aussi que la liquidité pourrait même s'améliorer en raison de l'absence des noise traders. Dans la même lignée, Schwert and Seguin (1993) affirment qu'une STT a plus d'externalités positives que d'externalités négatives. Plus récemment, Dávila (2020) propose un modèle de marchés financiers compétitifs pour déterminer le niveau optimal de la STT à l'équilibre. Il estime que le taux de taxe optimal est positif car les gains engendrés par la réduction des transactions non fondamentales compensent les pertes dues à la réduction des transactions fondamentales.

Au contraire, Matheson (2011) estime qu'une taxe sur les transactions financières serait plus néfaste qu'utile. Il prédit que les prix des titres et les volumes d'échanges à court terme diminueraient, ce qui se traduirait tout d'abord par des profits plus faibles pour les entreprises financières, qu'elles compenseraient par des coûts plus élevé auprès de leurs clients. Habermeier and Kirilenko (2003) s'opposent fermement à l'introduction d'une TTF. Ils affirment que la STT aurait des effets négatifs sur la découverte des prix, la volatilité et la liquidité et impliquerait une réduction de l'efficacité informationnelle des marchés. Dupont and Lee (2007) évaluent les effets d'une STT sur la profondeur et le bid-ask spread en utilisant un modèle statique dans lequel un teneur de marché compétitif est confronté à des traders informés et à des noise traders. Ils constatent qu'en cas d'asymétrie d'information, l'impact de la taxe sur la liquidité peut être positif ou négatif, selon la microstructure du marché.

Kupiec (1996) étudie l'impact d'une STT sur la volatilité et les prix en utilisant un modèle d'équilibre général. Il constate que la volatilité peut diminuer légèrement et que la baisse des prix des actions dépasse les recettes fiscales collectées. Il conclut toutefois que l'effet global d'une STT est positif. Sur la base d'un modèle d'équilibre microéconomique similaire, Palley (1999) observe que même si une STT peut freiner les transactions des investisseurs fondamentaux pour des raisons fiscales, elle va aussi limiter l'activité des noise traders, ce qui pourrait être bénéfique pour la qualité du marché.

Le cas des noise traders est approfondi par Song and Zhang (2005). Ils concluent, sur la base de leur modèle d'équilibre général, qu'une part faible (élevée) de noise traders et une faible (forte) volatilité pré-STT entraînent une diminution (augmentation) de la volatilité. Plus récemment, Lendvai et al. (2014) utilisent un modèle d'équilibre général pour évaluer les effets d'une STT dans l'Union Européenne (EU). Leur simulation prévoit une augmentation des recettes équivalant à 0,1% du PIB de l'UE et une diminution à long terme du PIB d'environ 0,2%.

Par ailleurs, les conséquences des paradis fiscaux n'ont été modélisées explicitement que récemment. Mannaro et al. (2008) et Westerhoff and Dieci (2006) analysent des modèles avec deux marchés où

les traders peuvent choisir sur quel marché négocier et où une taxe Tobin est appliquée soit sur les deux marchés, soit sur un seul d'entre eux, laissant l'autre marché comme paradis fiscal. Les deux études montrent que l'introduction de la taxe sur un seul marché entraîne une forte diminution du volume des échanges sur le marché taxé. Alors que Mannaro et al. (2008) s'attendent à une augmentation de la volatilité sur le marché taxé, Westerhoff and Dieci (2006) affirment que la volatilité diminue sur le marché taxé, mais augmente sur le marché non taxé. Ces derniers insistent sur le fait que la relation entre la liquidité et la volatilité est difficile à évaluer dans la pratique, c'est pourquoi Westerhoff and Dieci (2006) préconisent une approche expérimentale de la question.

Bloomfield et al. (2009) ont mené une expérience en laboratoire pour étudier le comportement des traders sur les marchés lors de l'introduction d'une STT. Ils s'intéressent particulièrement aux effets d'une STT sur trois types de traders qu'ils appellent "informed traders", "liquidity traders" et "noise traders". Leurs résultats expérimentaux suggèrent qu'une STT entraîne une diminution du noise trading, ce qui augmente l'efficience informationnelle. Le volume est réduit par la taxe, tandis que la volatilité est à peine affectée. L'une des limites du cadre utilisé dans Westerhoff and Dieci (2006) est sa restriction à un seul marché. Dans un tel cadre, il est impossible d'examiner comment un marché est affecté par une taxe Tobin en présence d'autres marchés non taxés, c'est-à-dire s'il existe des paradis fiscaux.

Revue de la littérature empirique

Alors que la recherche théorique se concentre sur la modélisation de différents groupes de traders et leur réaction à une STT, la recherche empirique analyse des paramètres de qualité du marché bien connus. Ces paramètres, qui font également l'objet d'études théoriques (section précédente) sont essentiellement : i) la volatilité (par exemple, l'écart type des prix), ii) la liquidité (par exemple, le spread et le volume de trading).

Volatilité

Umlauf (1993) est parmi les premiers à observer que la volatilité a augmenté suite à l'introduction de la STT en Suède. Pomeranets and Weaver (2018) observent une augmentation (diminution) de la volatilité après une augmentation (diminution) de la taxe pour le cas de la STT de l'État de New York. Cela a également été observé par Baltagi et al. (2006) en Chine et par Sinha and Mathur (2012) en Inde. Dans une étude longitudinale portant sur 23 pays, Roll (1989) constate

une augmentation insignifiante de la volatilité accompagnée d'une STT. Hu (1998) ne trouve aucun effet sur la volatilité après l'introduction d'une STT dans quatre pays asiatiques (Hong Kong, Japan, Korea, and Taiwan). Ce résultat est également confirmé par Chou and Wang (2006) qui n'observent aucun effet sur la volatilité après une diminution de la taxe sur les transactions sur les marchés futurs de Taïwan. Green et al. (2000) ont distingué entre la volatilité fondamentale et la volatilité excessive. Ils constatent qu'avec une augmentation des coûts de transaction, la volatilité fondamentale diminue et la volatilité du marché augmente. Une augmentation de la volatilité causée par une hausse des coûts de transaction est également observée par Hau (2006) en France et Lanne and Vesala (2010) en Allemagne, aux États-Unis et au Japon. En outre, la déréglementation des commissions fixes, qui a entraîné une baisse des coûts de transaction, a provoqué une diminution de la volatilité aux États-Unis (Jones and Seguin, 1997). Dans le cas de la STT française, l'impact sur la volatilité est statistiquement non significatif, quel que soit la façon dont la volatilité est mesurée (rendements absolus ou carrés, variance conditionnelle (Capelle-Blancard and Havrylchyk, 2016), la volatilité réalisée (Colliard and Hoffmann, 2017), l'écart-type des prix (Gomber et al., 2015).

Volume

Pomeranets and Weaver (2018) constatent qu'une hausse (baisse) d'une STT entraîne une baisse (augmentation) des volumes aux États-Unis. Baltagi et al. (2006) approfondissent la question en quantifiant le niveau de taxation. Ils constatent que l'élasticité du volume par rapport au niveau de taxation est de 100%, c'est-à-dire qu'un doublement du niveau de taxation réduit le volume de moitié. Dans le cas de la mise en œuvre d'une STT suédoise, Umlauf (1993) observe une baisse du volume ainsi qu'un déplacement vers les marchés britanniques. La réduction du niveau de la taxe sur les transactions a été étudiée par Chou and Wang (2006). Ils constatent une augmentation significative des volumes de transactions après la réduction du taux, ce qui confirme la relation inverse entre le niveau de taxation et le volume. Sinha and Mathur (2012) observent un glissement inter-marchés des grandes entreprises vers les moyennes et petites entreprises après l'introduction d'une STT. Ils concluent que les investisseurs pourraient avoir modifié leur stratégie d'investissement. Contrairement à ces résultats, Hu (1998) n'observe aucun changement significatif du volume sur quatre marchés asiatiques. Des études plus récentes sur la STT française mise en œuvre en 2012 ont estimé que le volume des échanges avait diminué de 15 à 30% (Capelle-Blancard and Havrylchyk, 2016; Colliard and Hoffmann, 2017; Gomber et al., 2016), tandis que la baisse de volume estimée à la suite de la mise en œuvre de la TTF italienne en 2013 était plus modeste (Capelle-Blancard and Havrylchyk, 2016).

Liquidité

Les études des effets sur la liquidité en liaison avec une STT sont rares jusqu'à présent. Pomeranets and Weaver (2018) appliquent la mesure de liquidité de l'Amihud (2002) et trouvent une relation directe avec le taux de la STT. Afin de valider leur résultat, ils utilisent le spread relatif, comme le suggère Holden (2009). Ils découvrent qu'une augmentation (diminution) du taux STT augmente (diminue) les spreads relatifs. Comme la mesure de l'Amihud (2002) augmente et que le spread s'élargit, ils concluent que la liquidité après l'introduction d'une STT se détériore. Chou and Wang (2006) évaluent la diminution de la taxe sur les transactions sur les marchés futurs de Taïwan et constatent également une augmentation de la liquidité en cas de réduction de la taxe. Lepone and Sacco (2013) montrent que la taxe sur les transactions financières au Canada a entraîné une augmentation significative des spreads bid-ask pour les actions ayant une plus grande capitalisation boursière. Dans le cas de la STT française, Il n'y a pas d'impact significatif sur les mesures théoriques de la liquidité, telles que l'impact sur les prix qui saisit la capacité à négocier de grandes quantités rapidement, à faible coût et sans faire varier le prix (Meyer et al., 2015; Capelle-Blancard and Havrylchyk, 2016).

Dans l'ensemble, la revue de la littérature a montré que toute mise en place d'une taxe de type Tobin sera ambiguë et aura des résultats diversifiés. Selon Uppal (2011), les modèles théoriques donnent des conclusions différentes en raison des différentes hypothèses. Les modèles théoriques comprennent notamment les modèles à agents hétérogènes, les modèles d'intelligence nulle, les approches de la théorie des jeux et enfin les expériences de laboratoire ou les marchés simulés qui permettent de tester les modèles précédents. Les études empiriques ont deux directions principales : a) la littérature liant les coûts de transaction et la volatilité dont la majorité des études concernent le marché des actions et, en second lieu, le marché des changes. Et b) la littérature complémentaires concernant l'impact de la TTF sur i) la liquidité et ii) le volume.

Cette thèse s'inscrit dans la filière empirique. Plus précisément, nous évaluons l'impact de tout mécanisme de taxation (STT, augmentation du multiplicateur, taxe sur les gains en capital) à la fois sur les mesures de volatilité et de liquidité. Avant de détailler le contenu de chacun des 3 chapitres, nous présentons les motivations et contexte de nos recherches.

Motivations

La STT en tant qu'outil de régulation ?

Certaines évolutions du secteur financier au cours des décennies précédant la crise financière de 2008 ont rendu le système financier global susceptible de connaître des crises graves et profondes (Constâncio, 2017). Diverses défaillances ont contribué à cette crise - telles que la prise de risques excessifs, l'opacité des positions sur les produits dérivés qui produisent des externalités négatives et dangereuses et s'exercent sur d'importantes institutions bancaires (Acharya et al., 2011).

Dans ce contexte de prévention des crises, l'un des principaux objectifs de la TTF est de modérer les volumes de transactions en ciblant les opérations à court terme, qui sont souvent considérées comme les principaux moteurs de la spéculation, afin d'améliorer la stabilité du marché. Les activités spéculatives à court terme peuvent avoir un effet déstabilisateur et accentuer les périodes de turbulences du marché. La spéculation peut entraîner des écarts de prix importants par rapport aux fondamentaux - les "bulles". Ces "bulles" et la croissance excessive du volume de crédit ont été identifiées comme des précurseurs importants de crises économiques profondes (Brunnermeier and Oehmke, 2013; Jordà et al., 2015). En outre, la TTF peut être un outil de collecte de recettes fiscales, surtout à un moment où les déficit fiscaux se sont fortement creusés.

Pour les opposants, une TTF augmentera les coûts de transaction, elle diminuera l'efficacité du marché : les prix seront moins informatifs, les volumes de transactions diminueront et la liquidité diminuera (Bond et al., 2005; Habermeier and Kirilenko, 2003). En conséquence, cela augmentera les coûts de financement pour les entreprises, et réduira le rendement des investissements des clients et des fonds de pension, par exemple. Les opposants ont également fait valoir qu'en l'absence d'une action coordonnée au niveau international, des efforts importants seraient consacrés à la fraude vers des paradis fiscaux. Étant donné l'absence de consensus autour de la théorie, de nombreuses études empiriques ont été menées afin d'éclairer le débat. Cependant, celles-ci n'ont pas permis de conclure le débat. Dans ce contexte, cette thèse contribue à la littérature empirique sur l'efficacité de la taxation et réglementation des marchés financiers. En plus de contribuer à la littérature foisonnante sur les impacts d'une STT dans le troisième chapitre, nous contribuons aussi à la littérature plus restreinte sur les implications d'une politique de type taxe Tobin sur le marché des produits dérivés dans les deux premiers chapitres.

Taxe sur les produits dérivés : qu'en est-il réellement ?

Les deux dernières décennies a vu le développement de nouveaux instruments financiers en évolution rapide et variée. Suite à ces évolutions, le débat sur la taxe s'est tourné vers ces nouveaux instruments, notamment les produits dérivés et le trading à haute fréquence. Les partisans soulignent le fait que taxer seulement les actions offre la possibilité aux investisseurs de se tourner vers des

instruments non taxés (tel que les produits dérivés). En effet, si les produits dérivés ne sont pas taxés, ils peuvent être structurés de manière à être économiquement équivalents à l'achat d'un titre sous-jacent, ce qui permet aux acteurs du marché d'éviter la TTF (Shaviro, 2012). Ce phénomène a été observé avec certaines TTF existantes - comme celles du Royaume-Uni, de la France et de Hong Kong – où la TFF ne s'applique pas aux produits dérivés, puisque ces derniers posent des problèmes conceptuels et administratifs. Par conséquent, les débats portent désormais essentiellement sur la taxation des instruments dérivés et la prise en compte des transactions intra-journalières, qui représentent la très grande majorité des volumes mais qui sont, de fait, exemptées par les taxes en vigueur. Cependant, quelques rares pays tels que l'Inde et la Corée du sud ont élargi le champ d'application de la STT à certain produits dérivés. L'Inde, par exemple, taxe les futures et les options. Les Futures sont taxés sur la base de leur prix de livraison, tandis que les options sont taxées à la fois sur leur prime et sur leur prix d'exercice. Le manque d'études empiriques sur cette importante question de réglementation du marché des produits dérivés me semble être une carence dans le débat. Ainsi, mes deux premiers chapitres évaluent deux politiques de régulation de produits dérivés.

Dans cette perspective, le cas de la Corée du sud nous offre une opportunité unique et nous permets de mener une analyse rigoureuse sur les effets de la réglementation sur le marché des produits dérivés. Tout particulièrement parce que les produits dérivés sont très populaires en Corée auprès des investisseurs individuels, contrairement au pays développés, ou les produits dérivés sont plutôt réservés aux investisseurs institutionnels, nationaux et étrangers. En effet, les investisseurs individuels nationaux représentent ainsi une part importante du volume total des transactions sur les marchés de produits dérivés coréen.

Dans ce contexte, le premier chapitre étudie la régulation du marché des options coréen, suite à la hausse du multiplicateur dans le but de limiter l'activité spéculative. Il s'agit d'une approche originale, puisque pour la première fois sur un marché financier de produits dérivés, le niveau du multiplicateur sera multiplié par 5. Cette augmentation vise à évincer une catégorie spécifique d'investisseurs : les noise traders. Après la hausse du multiplicateur en 2011, les autorités coréennes ont introduit un impôt sur les gains en capital (CGT) en 2016. Le gouvernement coréen souhaitait : i) maintenir l'exclusion des noise traders et ii) générer des revenus supplémentaires. La structure de la CGT coréenne est unique : elle n'est pas basée sur le montant de la transaction (délicat à définir dans le cas des produits dérivés), mais sur les gains en capital. Cette architecture nous permet ainsi de tester pour la première fois l'efficacité de ces outils de régulation et de taxation sur un marché de produits dérivés ; et par conséquent de proposer des recommandations politiques

pour la Corée ainsi que pour d'autres places boursières qui souhaiteraient cibler les marchés de produits dérivés.

Qu'en est-il réellement de l'impact de long terme de la STT ?

La plupart des études se concentrent sur les effets à court terme. Elles ne sont pas en mesure d'identifier les effets éventuels à long terme sur la stabilité des marchés financiers (McCulloch and Pacillo, 2011). Dans ce contexte, le troisième chapitre, évalue les impacts à long terme de la STT en France. Grâce à la configuration de la STT française, ainsi qu'à la méthodologie mise en place, nous sommes en mesures d'apporter des réponses quant aux impacts d'une telle mesure sur un horizon de long terme.

Dans ce qui suit, nous présentons les principales contributions de cette thèse de doctorat en résumant l'objectif, la méthodologie et les résultats de chaque chapitre.

Contributions

Chapitre 1: "The effect of the increase of Kopsi 200 multiplier on price volatility and options market efficiency"

Ce chapitre fournit une évaluation claire de l'impact de la hausse du multiplicateur des options du KOSPI 200 sur la participation des investisseurs et l'efficacité du marché. Nous utilisons deux mesures de l'efficacité du marché : la part de participation des ≪ noise traders ≫ et la volatilité asymétrique. Premièrement, le passage à une unité de négociation cinq fois plus élevée peut entraîner la sortie d'un nombre important de petits investisseurs du marché. Par conséquent, nous menons une analyse descriptive sur la manière dont le nombre de transactions des particuliers, des institutions et des négociants étrangers a changé après l'annonce de l'augmentation du multiplicateur et également après son implémentation sur le marché. Ensuite, nous étudions empiriquement si la volatilité asymétrique a augmenté ou diminué suite à la réforme sur le marché des options KOSPI 200. Pour mener à bien notre étude, nous utilisons des données quotidiennes relatives aux options d'achat et de vente pour la période 2011-2013 (743 jours de bourse) fournies par la Korea Exchange (KRX). De plus, afin d'estimer la volatilité asymétrique, nous utilisons une méthode des séries temporelles et plus précisément un modèle EGARCH. Le modèle a été légèrement affiné pour tenir compte d'un changement possible de la volatilité suite à deux événements : (i) l'annonce de l'augmentation du multiplicateur et (ii) la mise en œuvre de l'augmentation du multiplicateur.

La contribution de ce chapitre repose sur trois éléments clés. i) Le multiplicateur coréen sur les produits dérivés est unique : alors que la plupart des changements réglementaires dans le monde concernant les unités de négociation impliquent des réductions, la KRX va dans la direction opposée : une augmentation. Cela fournit pour la première fois un cadre dans lequel on peut évaluer l'impact d'une diminution du nombre d'opérateurs individuels sur l'efficacité du marché. ii) La KRX est également l'un des marchés de produits dérivés les plus liquides au monde. Plus important encore, par rapport aux marchés boursiers et dérivés américains, qui ont de multiples teneurs de marché, chaque transaction sur le marché des options KOSPI 200 passe par un seul système d'appel électronique. Cette caractéristique nous permet d'obtenir un ensemble de données de haute qualité avec des informations plus précises sur les différents groupes d'investisseurs sur le marché. iii) Le marché coréen des produits dérivés se caractérise par une très forte proportion d'investisseurs individuels, ce qui nous donne la possibilité de tester l'impact de l'augmentation des multiplicateurs sur les opérations spéculatives.

Les résultats montrent que la quantité de transactions des investisseurs individuels a été considérablement réduite en termes absolus. La part des investisseurs institutionnels et étrangers dans les transactions augmente d'environ 4 points entre 2011 et 2012. Toutefois, étant donné la faible augmentation de la part des investisseurs institutionnels et étrangers dans le total des transactions, il est difficile d'affirmer que l'augmentation du multiplicateur des transactions a empêché de manière significative les investisseurs individuels d'entrer sur le marché. Enfin, notre analyse empirique confirme une réduction significative de la volatilité asymétrique suite à l'annonce et à la mise en œuvre de la réforme. Ces résultats confirment que les petits investisseurs participent à l'augmentation de l'excès de volatilité sur le marché des produits dérivés.

Chapitre 2: "Capital gains tax and market quality: Evidence from the Korean market"

Dans ce deuxième chapitre, nous examinons l'impact de la taxe sur les gains en capital (CGT) sur la qualité et l'efficience du marché des options du KOSPI 200 : à notre connaissance, notre étude est la première du genre. Nous utilisons diverses mesures de la liquidité du marché : le volume des transactions, la valeur des transactions, et l'écart de prix entre les cours acheteur et vendeur. Notre échantillon se compose des contrats à terme du KOSPI 200 et Mini KOSPI 200 d'août 2015 à décembre 2016. Pendant cette période, initialement, ni le KOSPI 200 ni le Mini KOSPI 200 n'ont été taxés (août 2015-décembre 2015). Ensuite, à partir du 1er janvier 2016, une CGT de 10% a

été appliquée aux revenus provenant des transactions sur les contrats à terme du KOSPI 200, alors que la taxe ne s'appliquait pas au Mini KOSPI 200. Enfin, en juillet 2016, le Mini KOSPI 200 a été soumis à la taxe sur les gains en capital. Ce délai de 6 mois entre l'imposition du KOSPI 200 et du Mini KOSPI 200 est totalement ad-hoc. Nous avons donc deux expériences quasi-naturelles qui se prêtent très bien à l'analyse des modèles de différences en différences (DiD).

La contribution de ce deuxième chapitre est renforcé par l'organisation spécifique du marché coréen des produits dérivés, qui nous donne d'ailleurs l'occasion de procéder à une analyse causale rigoureuse. Il repose sur trois éléments clés. i) La conception de la CGT coréenne sur les produits dérivés est unique : elle ne repose pas sur le montant de la transaction (délicat à définir dans le cas des produits dérivés), mais sur les plus-values. ii) Lorsque le gouvernement coréen a décidé de taxer les produits dérivés KOSPI 200, il s'est concentré sur les contrats KOSPI 200 mais a complètement ignoré les contrats Mini KOSPI 200, qui sont pourtant très similaires. En fait, les produits dérivés Mini KOSPI 200 ont été soumis à la CGT six mois plus tard. Ce délai nous offre une expérience quasi-naturelle significative. iii) Le marché coréen des produits dérivés est caractérisé par une très forte proportion d'investisseurs individuels, ce qui nous donne l'occasion de tester l'impact de la taxation sur les opérations spéculatives.

Les résultats de l'analyse de DiD montrent que l'introduction de la CGT sur le marché des produits dérivés coréen a réduit le volume et la valeur des transactions, mais qu'elle n'a pas eu d'effet significatif sur le bid-ask spread. Un examen plus approfondi des activités des différents types de traders montre un déplacement de l'activité de négociation des investisseurs individuels vers les négociateurs institutionnels (qui sont exemptés de la taxe) et des produits dérivés KOSPI 200 vers les Mini KOSPI 200.

Chapitre 3: "Revisiting the impact of the French Securities Transaction Tax" co-écrit avec Gunther Capelle-Blancard

Dans ce troisième chapitre, nous évaluons l'impact de la taxe sur les transactions de valeurs mobilières (STT) française sur la liquidité et la volatilité du marché. Contrairement aux études précédentes, le format de la STT Française nous permet de tester son effet sur une plus longue période 2012-2019. L'échantillon des sociétés qui sont taxées s'ajuste chaque année en fonction de l'évolution de leur capitalisation boursière annuelle. En effet, La STT Française s'applique aux sociétés dont le siège social est situé en France et dont la capitalisation boursière dépasse un milliard d'euros le 1er décembre de l'année précédente.

Du point de vue méthodologique, nous nous appuyons sur deux stratégies d'estimation : (i) une approche standard de différence en différence (DiD) mise en œuvre chaque année séparément et (ii) un modèle de données de panel à effet fixe. Les résultats montrent que l'impact négatif de la STT sur l'activité du marché ne s'est produit qu'au moment de l'introduction de la taxe en août 2012. Depuis lors, les nouvelles entreprises taxées n'ont pas connu de diminution de la liquidité, quelle que soit la façon dont elle est mesurée, et les entreprises qui ne sont plus taxées n'ont pas bénéficié d'une amélioration de la liquidité. L'augmentation du taux d'imposition en 2017 (de 0,2 à 0,3%) n'a pas non plus eu d'impact significatif. Dans l'ensemble, contrairement aux inquiétudes exprimées avant son introduction, la STT ne semble pas avoir été préjudiciable au marché boursier Français.

Chapter 1

The effect of the increase of KOSPI 200 multiplier on options market efficiency

Emna KHEMAKHEM

1.1 Introduction

In 2012, the most liquid options market in the world at that time - the KOSPI 200 options market - faced a major reform implemented by the Korean government. Specifically, over three month period from March to June 2012, the option multiplier increased from 100,000 Korean Won (KRW) to KRW 500,000. This increase to a five-times-larger minimum trading unit (MTU) could bars and drive a significant number of investors with small capital from out of the market, many of whom were believed to trade for speculation. Such investors are typically thought of as noise traders and, as such, it is often thought that they contribute to prices being less efficient records of information Black (1976). But is it necessary that a decrease in noise traders be associated with weaker volatility and more efficient pricing? To contribute to the debate about the role of noise trader, we assess how the increase of multiplier for KOSPI 200 options affects investor participation and whether it altered market efficiency?

Little consensus exists on the effect of individual traders on market efficiency and on the mechanism underlying the effect. Black (1976), among others, calls retail investors *noise traders* because they

have less ability to collect and interpret market information relative to institutional investors. A first branch of the literature has shown that individual investors trade for non-fundamental reasons that can affect or destabilize share prices Lee et al. (1991); Odean (1998b,a, 1999); Kumar and Lee (2006); Barber et al. (2008). The underlying mechanism shows that small traders may have access to information but wrongly interpret it. Moreover, even if they make correct interpretations, they may not be able to make appropriate trading decisions. It is also possible that noise traders negotiate on the basis of what they believe to be correct information, when it is actually incorrect. Whatever the reason, since trading by noise traders is not based on complete information, their trades can add noise to prices, increasing temporary price fluctuations and inflating short-term return volatility (Black, 1976). However, considering all individual investors as noise traders can be misleading. Indeed, a second branch of the literature argues that not all individuals operate according to a similar pattern and, consequently, some individual investors can contribute to price efficiency (Coval et al., 2005; Dhar and Zhu, 2006; Griffin and Zhu, 2006; Nicolosi et al., 2009). Admati and Pfleiderer (1988) argue that informed trading is a positive function of liquidity trading. Since informed traders profit at the expense of uninformed traders, the increase in uninformed trading may motivate informed investors to engage more aggressively in informed trading. Thus, increased trading by small investors will attract more informed trading, which will improve price efficiency. Finally, which of the above two mechanisms regarding the role of retail investors on price efficiency is at work is an open empirical question.

To participate to this debate, the KOSPI 200 option market provides a very suitable environment to carry out a rigorous causal analysis in a unique and a relevant framework. Indeed, the contribution of this paper is based on three key ingredients. i) The design of Korean multiplier on derivatives is unique: while most regulatory changes in the world regarding trade units involved reductions, the Korean Exchange (KRX) case was going in the opposite direction: an increase. [1] This provides for the first time a framework in which one can assess the impact of a multiplier increase on individual traders participation and market efficiency. ii) KRX is also one of the most liquid derivative markets in the world. More importantly, compared to the US stock and derivatives markets, which have multiple market makers, every trade in the KOSPI 200 options market goes through a single electronic call system. This feature allows us to obtain a high-quality dataset with more accurate information on the different investors group in the market. iii) The Korean derivatives market is characterised by a very high proportion of individual investors, which gives us the opportunity to

1. Sydney Futures Exchange, SPI stock index futures and of US S&P 500 futures all three markets place cut the multiplier.

test the impact of multiplier increase on speculative trading. [2]

This paper assess the impact of the multiplier increase of KOSPI 200 derivatives on two measures of market efficiency: share of small investor's participation and asymmetric volatility. First, as might be expected, the move to a minimum five-fold trading unit can result in a significant number of small investors exiting the market. Therefore, we conduct a descriptive analysis on how the transactions number of individuals, institutions, and foreigners traders have changed following the multiplier increase announcement and also its implementation into the market. Second, we investigates empirically whether the asymmetric volatility has increased or decreased following the KRX policy reform on KOSPI 200 options stock market. Asymmetric volatility allows investors to realize abnormal returns which invalidates the theoretical definition of market efficiency (Malkiel and Fama, 1970). [3] Indeed, a market is efficient if prices fully reflect all the information available on a given stock market, which results in investors not being able to realize abnormal returns due to information imbalances (Malkiel and Fama, 1970).

Our study relies on daily data for call and put options for the period 2011-2013 (743 trading days) provided by the KRX. Methodologically, time series econometric method and more precisely an Exponential GARCH (EGARCH) model is used to estimate the magnitude of the asymmetric volatility. The model was slightly refined to take into account a possible change in volatility following two events: (i) the announcement of the multiplier increase and (ii) the implementation of the multiplier increase. The results show that the size of individual investors transactions has been significantly reduced in absolute size and the same pattern comes out for the institutional and foreigners traders. However, institutional and foreigners investors' share transactions increases by about 4 points between 2011 and 2012. Therefore, given the small increase in institutional and foreigners investors' share in the total trades, it is hard to claim that the increase in the trading multiplier has significantly prevented individual investors from entering the market. Finally, despite the small share of noise traders exiting the market, our empirical analysis confirms a significant decrease in asymmetric volatility following the implementation of the multiplier policy reform. This result goes in line with the literature that shows that small investor participate to increase the excess of volatility in the derivatives market.

2. Unlike the major derivatives markets, where individuals account for less than 10% of the transactions, individual investors in the Korean market made up more than half of the activity of the KOSPI 200 derivatives market in the early 2000s. Still, in the recent years, more than 20% of transactions have been carried out by individual investors, a much higher percentage than on other derivatives markets in the United States and Europe.

3. Asymmetric volatility occurs when negative shocks have a greater impact on conditional volatility than positive shocks of the same magnitude.

The remainder of the paper is organized as follow. Section 1.2 describes the Korean market, details the MTU reform and briefly surveys the previous literature on the KOSPI derivatives market. Section 1.3 describes the data and section 1.4 lays out the empirical strategy. Section 1.5 discusses in detail market and group investor's reactions to multiplier increase. Section 1.6 and section 1.7 presents the preliminary analysis and the main results, respectively. Section 1.8 concludes.

1.2 The derivatives market in Korea

1.2.1 The Korea Exchange and the KOSPI 200 derivatives

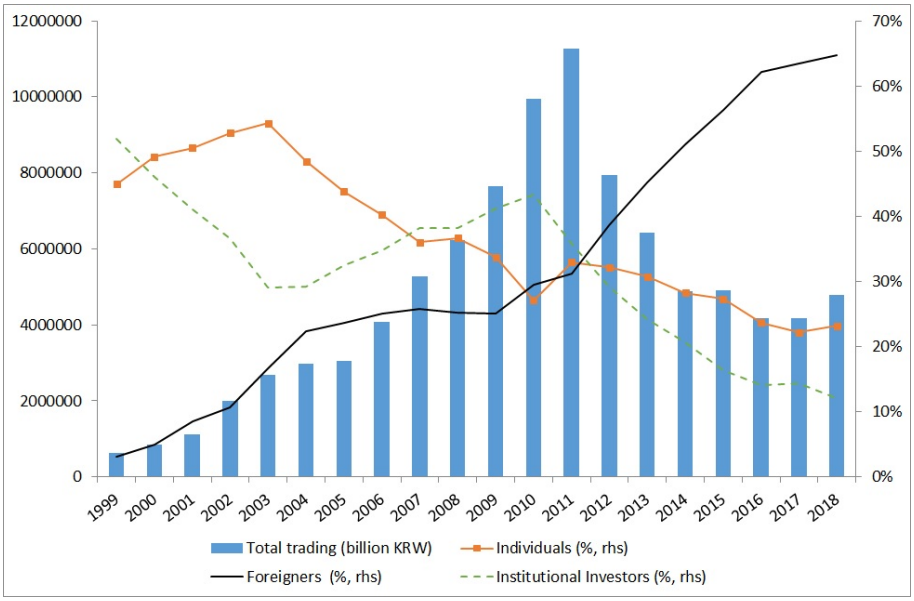
KRX is the only securities exchange operator in South Korea. Under the Korea Stock & Futures Exchange Act in 2005, KRX was created through the integration of the Korea Stock Exchange (initially established in March 1956), the Korea Futures Exchange and the Kosdaq Stock Market. The business divisions of Korea Exchange are: the Stock Market Division, the KOSDAQ Market Division and the Derivatives Market Division. KRX operates the centralized securities (stocks and bonds) and derivatives markets from 09:00 am to 03:30 pm (normal trading sessions) on all business days; it is a fully electronic limit order market without floor traders and all the products are traded on the common platform, EXTURE+. As of January 2015, Korea Exchange had more than 2,000 listed companies with a total market capitalization larger than US$1 trillion. It was the 15th largest financial market in the world in terms of market capitalization.

The Korean derivatives market is one of the world's largest derivatives markets, consistently ranked among the Top 10 by all criteria (see Table 1.7 in the Appendix). This market is highly concentrated on a few products, mainly equity index derivatives based on the Korea Composite Stock Price Index (KOSPI), established in 1964, and which comprise the top 200 listed stocks.

KOSPI 200 index futures and options were first listed in May 1996 and July 1997, respectively. Since then, they account for about 90% of the trades. The evolution of the trading value over the last twenty years is displayed in Figure 1.1. [4] There are clearly two distinct sub-periods. In the 2000s, the Korean derivatives market grew dramatically: In 1999, the trading amount in the KOSPI 200 derivatives was just around KRW 627,710 billion (approx. $500b) for futures and KRW 7,129 billion ($6b) for options; In 2011, the trading amount rose to KRW 11,260,000 billion ($10,000b) for futures and KRW 436,326 billion ($400b) for options. Accordingly, over the period, the average

4. The statistics used in this section are provided by KRX on its website.

Panel A: KOSPI 200 futures



Panel B: KOSPI 200 options

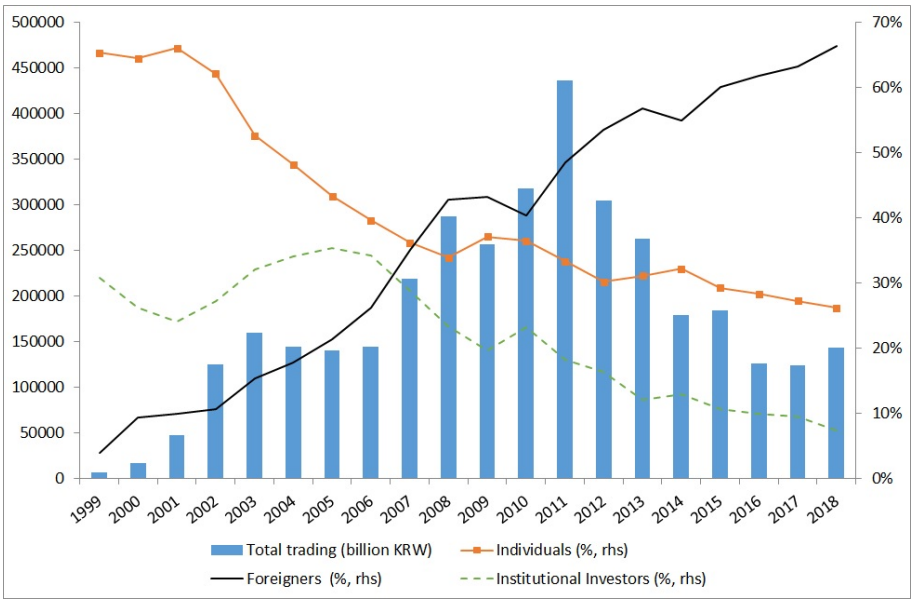


Figure 1.1: Trading value and proportion of investors by category for KOSPI 200 derivatives

annual growth rate of KOSPI 200 derivatives was more than 27%, while in comparison the average growth rate in the equity spot market was around 12%. [5] Since then, market activity has gradually

5. In the 2000s, the KOSPI 200 futures contract was ranked first in the world in terms of the number of contracts

decreased by half. In 2018, the trading amount in the KOSPI 200 futures was KRW 4,788,500 billion ($4,350b).

In July 2015, Mini KOSPI 200 futures and options has been introduced. These products are the same as KOSPI 200 derivatives, but they can be traded in smaller volume, starting from KRW 100,000, while the "standard" KOSPI 200 derivatives contracts can be traded at a minimum of KRW 500,000.

1.2.2 Individual investors in Korea

One of the main characteristics of the Korean derivatives market is the importance of individual investors. [6] KRX publishes detailed information on the transactions carried out by each category of investors: Individuals, Foreigners and Institutional Investors [7] – it should be noted that such information is rarely communicated by the other derivatives markets. The proportion for each categories is represented in Figure 1.1, along with the total trading value.

Unlike the main derivatives markets, where individuals account for less than 10% of the total transactions, individual investors in the Korean market made up more than half of the activity of the KOSPI 200 derivatives market in the early 2000s. It has long been a source of concern for the authorities. In particular, according to a survey by the Financial Supervisory Service in 2006, reported by Park (2011), the losses accumulated by individuals from 2002 to 2005 reached KRW 2 trillion (371 billion from futures and 1,713 billion from options), mainly to the benefit of institutional and foreign investors. [8] At the same time, the strong taste for speculation by Korean individual investors has largely contributed to the growth of the KOSPI 200 derivatives market. Various measures has been taken to limit speculative transactions and although it is difficult to observe a significant downturn at any given time, there is a clear and continuous downward trend. Still, in the recent years, more than 20% of transactions have been carried out by individual investors, a much higher percentage than on other derivatives markets in the United States and Europe.

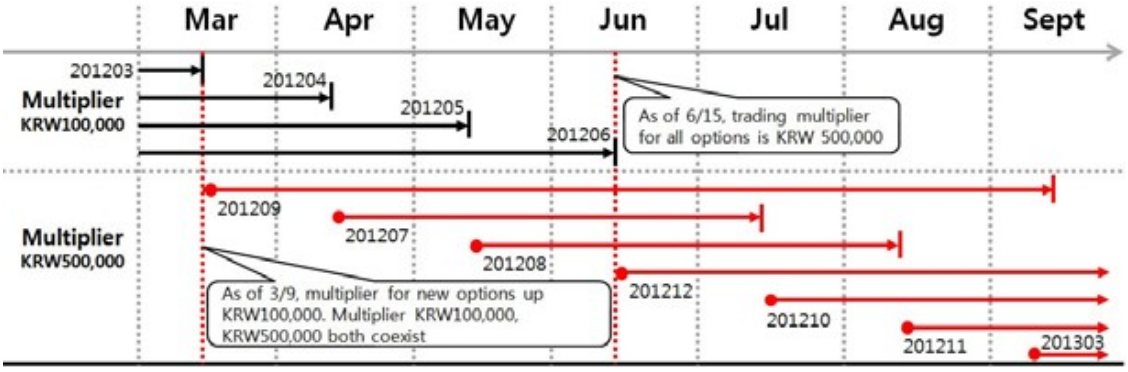
traded, but it was mainly due to the small size of the contract that artificially inflated the volumes. For the same reason, CNX Nifty Options, proposed by the National Stock Exchange of India, is regularly promoted as the number 1 equity derivatives contract in the 2010s, although its actual prevalence is less than that of S&P index derivatives for instance.

6. According to the Korean Statistical Information Service, the ratio of the population investing in the stock markets to the total population increased from 7.8% to 10.1% from 2004 to 2013 (data are no more available since). See Oh et al. (2008) for a study on the development of online investing in Korea in the 2000s.

7. This last group gathers the following sub-categories: Financial Investment, Insurance Companies, Investment Trusts, Bank, Other Financials, Pensions, Goverment and Others.

8. More precisely, Chou and Wang (2006) reports the number of winners/losers within each categories: From January to July 2004, one-third of the individual accounts record gains, while the other two-thirds record losses.

Figure 1.2: Monthly Changes of Options' Trading Multipliers



Source: Korea Exchange

1.2.3 Multiplier increase reform in Korea

On December 1, 2011, a first press release took place from KRX regarding the announcement of the increase of the KOSPI 200 options from KRW 100,000 to KRW 500,000. Three months after, on 9 March 2012, the KRW 500,000 multiplier is introduced into the market with the existing KRW 100,000 multiplier. A transitory period runs until mid-June. Indeed, gradually the smaller ones are withdrawn from the market, while the new multiplier is expanded increasingly. The financial authorities have maintained the multiplier of KRW 100,000 for April, May and June options, while the newly listed options from March 2012 will be at the multiplier of KRW 500,000 (see Figure 1.2). The aim of this reform is to curb excessive speculative trading of individual investors. Indeed, the increase of multipliers may discourage investors from participating to the market, by increasing the cost and reducing the leverage. Individual investors are more prone to be impacted by this measure because they are more likely to be active in the derivatives market for speculation and do not have the same funding capacity as institutional investors. Therefore, we analyze whether the share of participation of small investors (noise traders) and the asymmetric volatility (market efficiency) of the KOSPI 200 options market have improved since this multiplier reform.

In the next subsection, we briefly survey empirical evidence on the impact of the previous regulatory reforms in the Korean derivatives market.

1.2.4 Previous studies on the KOSPI derivatives market

Several academic studies have been devoted to the KOSPI 200 derivatives. Jung (2013a) provides a brief history of the derivatives market in Korea and attempts to explain the success of the KOSPI 200 derivatives market. He claims that, until 2011, the absence of tax, low transaction fee, low margin requirement and high volatility of the underlying index are the main factors explaining the high trading volume of the KOSPI 200 options. Moreover, he suggests that proportion of individual investors are also contributing factors that have differentiated the Korean derivatives market from other competing exchanges. This statement is supported by Ciner et al. (2006) who claim that trading on KOSPI 200 derivatives was mainly motivated by speculation. Kwon (2011) examine whether changes in the pre-margin requirements impact the proportion of individual investors in the KOSPI 200 options market and finds mixed results.

Guo et al. (2013) test the efficiency of the KOSPI 200 index options market and present clear evidence of violations of the martingale restriction. In the same vein, Sim et al. (2016) find that option prices often do *not* monotonically correlate with underlying prices; they also find that some violations are attributable to individual trades. [9]

Lee et al. (2015) and Kang et al. (2020) examine the role of High Frequency Traders (HFT) in the KOSPI 200 futures market from 2010 to 2014. The two studies show that HFT exploit low-frequency traders by taking the liquidity. [10]

1.3 Data and preliminary analysis

1.3.1 Data

To empirically test the relationship between the multiplier increase and market efficiency, we use the intraday transactions data of the KOSPI 200 options market from the KRX. The sample period is from January 3, 2011, to December 31, 2013 (743 trading days) and includes only the transactions occurring during continuous trading sessions (i.e., trading sessions beginning at 9:00 and ending

9. This does not necessarily mean that all inefficiencies should be attributed to individuals investors. Using data from the Korean stock exchange over the period 2004-2015 (as well as data from the Taiwan Stock Exchange and the Stock Exchange of Thailand), Ülkü and Rogers (2018) show that, contrary to the prevailing view that holds individual investors' trading responsible, the monday effect is mainly due to institutional investors' trading.

10. Other studies on the KOSPI 200 derivatives market include Kim et al. (2004) who examine volatility trading, Lee et al. (2015) who examine the price dynamics in the index derivatives markets, as well as Ahn et al. (2008) and Ryu (2015) who examine informed trading in KOSPI 200 index options.

at 15:05).[11] The dataset include transaction price, close price, trading volume and value, open interest, ask and bid prices, and intrinsic Black and Scholes volatility.

In order to fully exploit our data and eliminate (minimize) systematic biais, we apply various filters following Kim and Lee (2010). First, we exclude options with a maturity less than 6 days and more than 100 days to avoid liquidity-related bias. Second, we discard transaction prices that are lower than 0,02 point to reduce the impact of price discreteness. Third, since the KOSPI 200 options market is highly concentrated in shortest-term contracts, we use data with the shortest maturity. Forth, KOSPI 200 options have a large number of exercise prices for the same maturity month with liquidity and transaction prices that differ depending on the exercise price for each month of expiry. Therefore, we use only nearest the money options to enhance data reliability and ensure a single price for each strike price.[12] Last but not least, we divide our simple into two sub-periods: pre-regulation from January 3, 2011 to June 14, 2012 (360 trading days) and post-regulation from June 15, 2012 to December 31, 2013 (383 trading days).[13]

1.3.2 Descriptive analysis

Figure 1.3 plots call and put option prices and returns between January 3, 2011, to December 31, 2013. For call and put options's prices (Panel A), there is an upward trend until the first press release from KRX regarding the announcement of the increase of the multiplier of KOSPI 200 options from KRW 100,000 to KRW 500,000. Since then, the market undergoes a constant and slight decrease that seems to accelerate from 9 March 2012 to mid-June. This acceleration corresponds to the transitory period where the small multiplier is withdrawn from the market in favor of the higher one. Since mid-june, prices seems to be stable. However, these price series are unfortunately not usefull since they seems to be non-stationary. Therefore, we plot option's returns (Panel B) which seems to be stationary. One drawback of transform a serie as the first difference is the loss of the long term perspective. Indeed, we only see the short term variation.

Panel B shows call and put option's return. However, we can no longer distinguish any market reaction either from the first press release or the implementation day of the multiplier increase. We also observe that option's returns are highly volatile, with wide swings on some periods and

11. We consider June 15, 2012, as the effective date of the increase of the multiplier. Indeed, between March 9, 2012 and June 15 2012, the option trading multiplier is a mixture of KRW100,000 and KRW500,000.

12. The option with the smallest difference between daily basic asset price and exercise price is defined as nearest the money option.

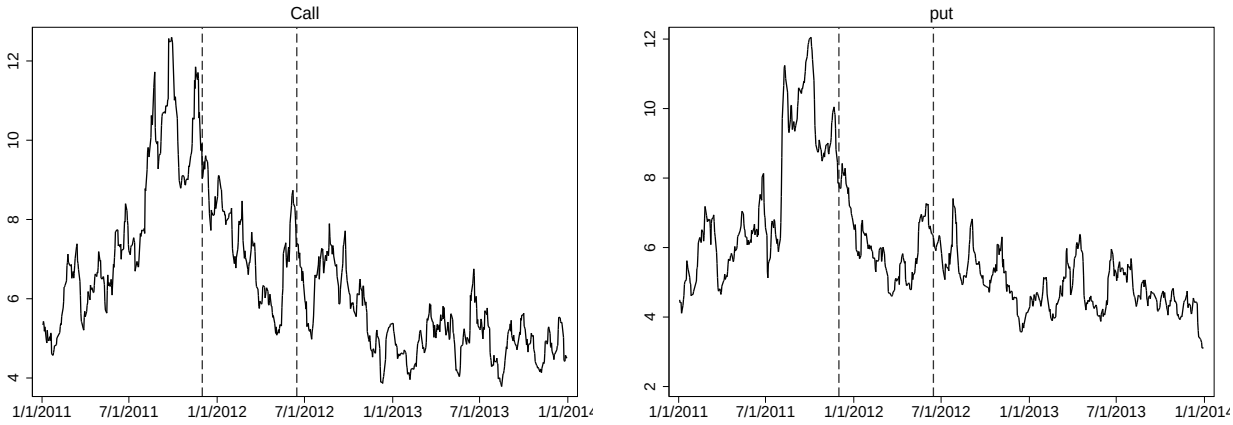
13. Excluding the period from March 9, 2012 to June 14, 2012 from the analysis does not change our results.

calm in others. This is a case of unequal variance, which may indicate autoregressive conditional heteroscedasticity (ARCH) effects. However, an ARCH effect cannot be inferred from panel B alone. Consequently, a rigorous testing strategy is conducted later in Section 1.6.

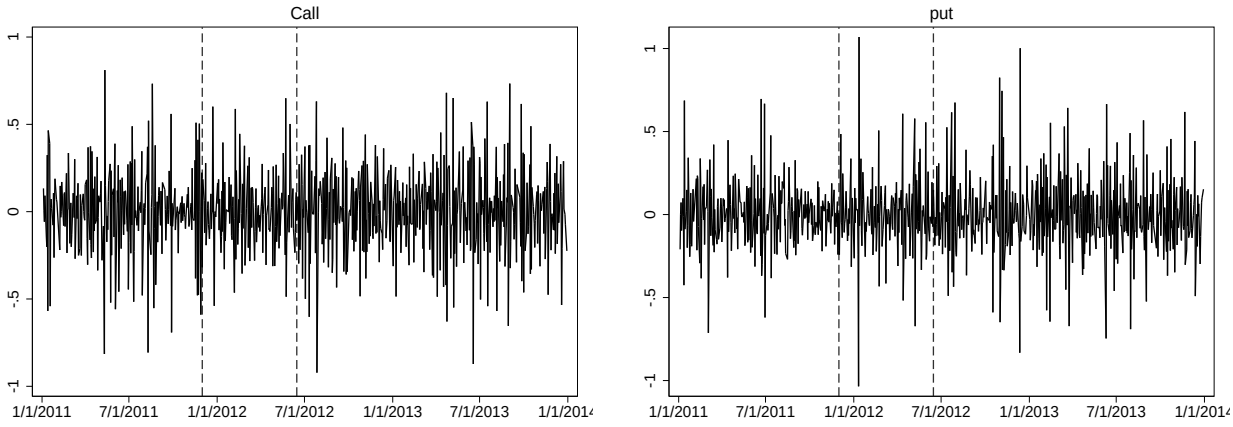
Figure 1.3: Call and Put option's prices and returns

These figures plot daily closing prices and returns for KOSPI 200 call and put options. We use nearest the money options with 35 days to expiration to standardize a large number of maturities and exercise prices. Panel A plots 3-day moving averages of closing prices and Panel B plots daily log returns computed as $returns = ln(closing_t - closing_{t-1})$. The sample period extends from January 3, 2011 to December 31, 2013 (743 trading days). The vertical dash lines indicate the date of the announcement on December 01, 2011 and the date of the implementation on June 15, 2012 of the multiplier, respectively.

Panel A: KOSPI 200 Call and Put options price



Panel B: KOSPI 200 Call and Put option's return



According to Bekaert et al. (1998), the majority of emerging markets show positive skewness, excess of kurtosis, and non-parametric distribution. To check the properties of our series, Table

Table 1.1: Summary statistics

This table provides descriptive statistics for KOSPI 200 call and put options. We use nearest the money options with 35 days to expiration to standardize a large number of maturities and exercise prices. Prices denotes closing prices and returns denotes the log returns computed as $returns = ln(closing_t - closing_{t-1})$. The sample period extends from January 3, 2011 to December 31, 2013 (743 trading days). All the data are daily. We present the sample mean, maximum, minimum, standard deviation, skewness and kurtosis values of the variables, as well as the Shapiro-Wilk test statistics for normality and Ljung-box Q (10) test statistics for white noise.

	Prices		Returns	
	Call	Put	Call	Put
Mean	6.439	5.877	-0.0004	-0.0004
Minimum	2.777	1.609	-0.921	-1.034
Maximum	20.870	14.375	0.810	1.069
Standard deviation	2.181	1.941	0.237	0.223
Skewness	1.539	1.368	-0.157	0.262
Kurtosis	7.316	4.933	4.113	5.968
Shapiro-Wilk	0.894***	0.886***	0.986***	0.957***
Ljung-box Q (10)	3036.081***	3483.863***	166.155***	163.295***

*, **, *** denote significant at the 10%, 5%, and 1% levels, respectively.

1.1 provides descriptive statistics of daily KOSPI 200 option prices and returns. First, the results show a positive skewness and excess of kurtosis for the KOSPI 200 options prices. Second, using the Shapiro-Wilk test, we find that our series are not normally distributed. In order to eliminate or at least reduce the skewness, for the rest of our study, we rely on the logarithmic transformation which is a convenient means of transforming a highly skewed variable into a more normalized series. Once we have log-linearized our series, we can run the appropriate model to assess the impact of multiplier increase reform on the market efficiency measures. We discuss the method in the next section.

1.4 Methodology

To investigate the consequences of the multiplier increase on the market efficiency, we rely on a EGARCH (1,1) model proposed by Nelson (1991) . This model allows to analyze how (i) the level of volatility react following the policy announcement and (ii) asymmetric volatility react following the policy implementation of the multiplier increase in the KOSPI 200 market option.

Standard GARCH models assume that good and bad news have the same effect on the volatility. As the conditional variance of this model depends only on the square of the error, positive and negative error terms have a symmetric effect on the volatility. However in practice, this assumption

is frequently violated by stock market returns since negative shocks lead to a larger increase of the conditional volatility than positive shocks. Black (1976) is the first to deal with this issue known as "the leverage effect". [14] explains this finding by the way firms are financed. When the value of the firm declines, the debt-to-equity ratio increases which leads to a higher volatility. Since the debt-to-equity ratio used to measure a company's financial leverage, the phenomenon of asymmetric volatility is also known as "leverage effect". To deal with this "leverage effect", we rely on the EGARCH which is an extension of the standard GARCH model and allows for asymmetric effects to be taken into account. We can write the mean equation as follows:

$$r_t = \mu + r_{t-1} + \varepsilon_t$$

Where r_t and r_{t-1} denotes options return in period t and $t-1$ respectively, μ is the constant term and ε_t denotes the unexpected return. We assume that $\varepsilon_t|\mathrm{w}_{t-1} \rightsquigarrow N(0, \sigma_t^2)$ where w_{t-1} denotes the information set at time $t-1$ and σ_t^2 is the conditional variance of the unexpected options return.

We also write the variance equation as follows:

$$ln(\sigma_t^2) = \omega + \alpha_1 Z_{t-1} + \gamma_1(|Z_{t-1}| - E(|Z_{t-1}|)) + \beta_1 ln(\sigma_{t-1}^2) + \nu_t$$

Where $Z_t = \varepsilon_t/\sigma_t$ denote a series of *iid* standardized random variables with 0 mean and unit variance. $g(Z_t) = \alpha_1 Z_{t-1} + \gamma_1(|Z_{t-1}| - E(|Z_{t-1}|))$ is a linear function that contains two parameters. The first part $\alpha_1 Z_{t-1}$ define the "sign effect" while the second part $\gamma_1(|Z_{t-1}| - E(|Z_{t-1}|))$ define the "size effect" of the shocks on volatility. $ln(\sigma_t^2)$ denote the logarithm of the conditional variance and $\nu_t \rightsquigarrow N(0,1)$ is the error term of the variance equation.

The function $g(Z_t)$ can be rewritten as:

$$g(Z_t) = (\alpha_1 + \gamma_1)Z_{t-1}^{+} + (\alpha_1 - \gamma_1)Z_{t-1}^{-} - \gamma_1 E(|Z_{t-1}|)$$

Where Z_{t-1}^{+} denotes positive shocks and Z_{t-1}^{-} negative ones. Consequently, the resulting impact of good news on the conditional variance is $(\alpha_1 + \gamma_1)$ while the impact of bad news is $(\alpha_1 - \gamma_1)$. If the $\alpha_1 < 0$ then a positive shock will have a lower impact on the conditional variance than a negative shock of the same magnitude. Knowing that we want to take into account a possible

14. Black (1976)

change in volatility following two events: (i) the announcement of the multiplier increase and (ii) its implementation, we slightly adapt the standard EGARCH model.

The variance equation becomes as follows:

$$ln(\sigma_t^2) = \omega_0 + \omega_1 \mathring{A}_t + \alpha_1 M_{t-1}^{Before} Z_{t-1} + \gamma_1(|Z_{t-1}| - E(|Z_{t-1}|)) + \alpha_2 M_{t-1}^{After} Z_{t-1} + \beta_1 ln(\sigma_{t-1}^2) + \nu_t$$

In the above equation, $w1$ represents the first event. It is the announcement effect on market volatility, since $\mathring{A}_t$ is a dummy equal to 1 after the KRX press release on the multiplier increase and zero otherwise. The impact may be both positive or negative, depending on the reaction of investors to this announcement. The second event corresponds to the implementation of the multiplier increase that may reduce or increase asymmetric volatility. M_t^{Before} denotes a dummy equal to 1 before the policy implementation and zero otherwise while M_t^{After} is a dummy equal to 1 since the policy implementation and zero otherwise. α_1 and α_2 capture the level of asymmetry before and after the policy implementation. Therefore, a quick comparison of these coefficients allows us to know whether the asymmetry have increased or decreased, which lead to a deterioration or an improvement of the market efficiency.

In what follows, we assess market and group investor's reactions to multiplier increase using descriptive statistics and EGARCH empirical model.

1.5 Market and group investor's reactions to multiplier increase

In 2012, KRX decides to regulate the options market in order to curtail the excessive speculative trading by excluding noisy individual investors from the market. Two measures are implemented: (i) A higher multiplier for the traded contract since 9 march, 2011 and (ii) a complete mandatory finance courses for individual investors if they want to enter into the market. Consequently, we are concerned about whether the reform of the KRX policy has achieved its objectives ?

Table 1.2 shows the descriptive statistics of the trading activity (trading volume, trading value and market share of investors) for three sub-periods: Before and after policy announcement, and also after the policy implementation. There is a significant decrease in liquidity of the option market and slight change in the market characteristics. Panel A shows a significant decline in total trading volume of call and put options directly after the announcement policy of about 25.7% and 17.3%, respectively. This decrease is even higher after the policy implementation and reached 77.0%,

78.8% for call and put, respectively. Concerning the trading value, we see the same pattern with a decrease of 26.0% and 36.4% for call and put following the policy announcement. This decrease is softer after the policy implementation with a decrease of about 1.7% and 10.2% for call and put, respectively. Panel B displays trading volume and value by investors groups (Institutions, individuals and foreigners) as well as the investor's market share. The trading volumes of domestic and foreign investors were balanced relatively before the market reform. For example, for call options, the total volume traded by domestic (individual and institutional) investors is about 62.3%, while the trades of foreign investors is about 36.8%. After the reform, the total volume traded by foreign investors has increased to 40.9% (+4.1 point), while the share of domestic investors decreased to 58.5% (-3.8 point). Similarly, before the reform, the total of value trading share investor's is about 34.5%, 17.0%, and 47.3% for individual, institutional and foreign investor's, respectively. After the reform, foreign investors share has increased to 52.7% (+5.4 point). Although, the share of institution and individual investors decreased to 15.08% (-1.2 point) and 30.4% (-4.1 point), respectively. [15]

Table 1.3 presents the option market liquidity by five option moneyness levels. When describing the option moneyeness, we use the criterion S/K (K/S) for call (put) option where S is the closing spot price and K is the exercise price. We define the moneyness category of an option as Deep Out-of-The-Money (DOTM) when moneyness$<$0.93, Out-of-The-Money (OTM) when 0.93$\leq$moneyness $<$ 0.97, At-The-Money (ATM) when 0.97$\leq$moneyness $<$ 1.03, In-The-Money (ITM) when 1.03$\leq$moneyness $<$ 1.07 and Deep-In-The-Money (DITM) when moneyness$\geq$1.07. The first remark is that trading volume declined for all moneyness following the multiplier increase implementation, with no suprise. However, among these differents moneyness, the most impacted one is the volume of DOTM call (put) options which have decreased by about 83.1% (77.7%). Interestingly, the DOTM is a good proxy of speculative trading. Therefore, this significant decrease in speculative trading following this KRX reform should reduce the asymmetric volatility into the Korean market. This intuition is tested in section 1.7.

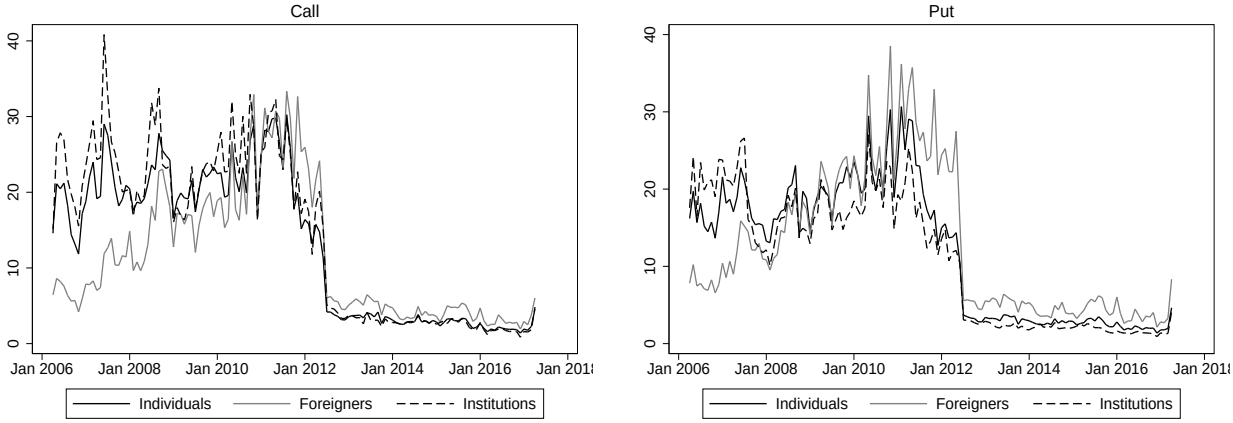
In the following, I provide some figures showing how market participants of KOSPI 200 reacted to the multiplier increase over a longer period (from January, 2006 to January, 2017) than provided in the Table 1.2. Panel A of Figure 1.4 shows a strong volume decrease that sustain in the long-run following the multiplier increase. This decrease occurs for all the three type of investors (see Table 1.6 in the Appendix for more details). Also, despite this sharp decline in trading volume, the KOSPI 200 options market is still very active and remains one of the world's most heavily traded

15. Table 1.6 in the Appendix details monthly trading volume and market shares by traders.

Figure 1.4: Monthly Call and Put option's trading volume and value

These figures plot monthly average trading volume in million (Panel A) and average trading value in million KRW (Panel B) for KOSPI 200 call and put options by investor type (Institutions, individuals and foreigners). The sample period extends from from April, 2006 to February, 2017.

Panel A: KOSPI 200 call and put trading volume by investor



Panel B: KOSPI 200 call and put trading value by investor

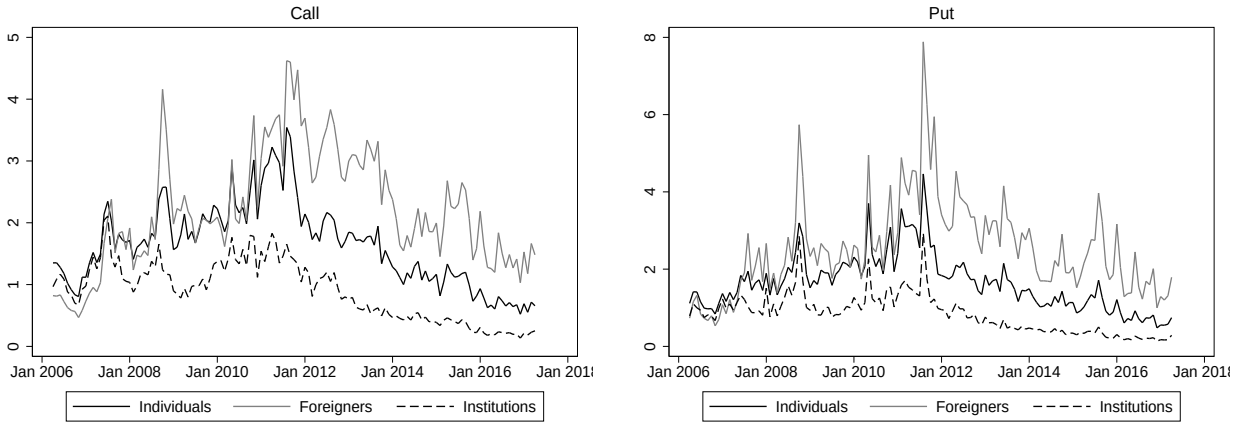


Table 1.2: KOSPI 200 Options trading activity by investor

This table provides descriptive analysis of the trading activity for KOSPI 200 call and put options. Panel A displays average trading volume and value, whereas Panel B details average trading activity by investor type (Individuals, institutions and foreigners) as well as the investor's market share in (). We divide the sample into three sub-periods: Before policy (from January 03, 2011 to November 30, 2011) in column 1, announcement policy (from December 01, 2011 to June 14, 2012) in column 2 and implementation policy (from June 15, 2012 to December 31, 2013) in column 3. Column 4 and 5 of this table displays the variation following announcement and implementation of the new multiplier, respectively.

		Average trading volume (in million)					Average Trading Value (in billion KRW)				
		(1)	(2)	(3)	(4) = $\frac{(2)-(1)}{(1)}$	(5) = $\frac{(3)-(2)}{(2)}$	(1)	(2)	(3)	(4) = $\frac{(2)-(1)}{(1)}$	(5) = $\frac{(3)-(2)}{(2)}$
Panel A											
Total	Call	7.759	5.764	1.324	-25.7%	-77.0%	849.58	628.97	618.19	-26%	-1.7%
	Put	6.336	5.242	1.111	-17.3%	-78.8%	1017.424	647.272	581.218	-36.4%	-10.2%
Panel B											
Call	Individuals	2.409	1.560	0.363	-35.2%	-76.8%	293.53	193.02	187.98	-34.2%	-2.6%
		(31.0%)	(27.1%)	(27.4%)	(-4.0%)	(0.3%)	(34.5%)	(30.7%)	(30.4%)	(-3.9%)	(-0.3%)
	Institutions	2.427	1,815	0.411	-25.2%	-77.4%	144.64	110.03	97.94	-23.9%	-11.0%
		(31.3%)	(31.5%)	(31.1%)	(0.2%)	(-0.4%)	(17.0%)	(17.5%)	(15.8%)	(0.5%)	(-1.7%)
	Foreigners	2.859	2.341	0.541	-18.1%	-76.9%	401.86	319.05	325.97	-20.6%	2.2%
		(36.8%)	(40.6%)	(40.9%)	(3.8%)	(0.2%)	(47.3%)	(50.7%)	(52.7%)	(3.4%)	(2.0%)
Put	Individuals	1.979	1.461	0.317	-26.2%	-78.3%	310.658	189.762	173.102	-38.9%	-8.8%
		(31.2%)	(27.9%)	(28.5%)	(-3.4%)	(0.6%)	(30.5%)	(29.3%)	(29.8%)	(-1.2%	(0.5%)
	Institutions	1.515	1.303	0.270	-14.0%	-79.3%	159.266	95.936	74.935	-39.8%	-21.9%
		(23.9%)	(24.9%)	(24.3%)	(1.0%)	(-0.6%)	(15.7%)	(14.8%)	(12.9%)	(-0.8%	(-1.9%)
	Foreigners	2.788	2.432	0.515	-12.8%	-78.8%	537.272	355.401	327.155	-33.9%	-7.9%
		(44.0%)	(46.4%)	(46.4%)	(2.4%)	(0.0%)	(52.8%)	(54.9%)	(56.3%)	(2.1%)	1.4%)

Table 1.3: KOSPI 200 Options trading activity by Moneyness

This table provides descriptive analysis of the trading activity for KOSPI 200 call and put options by moneyness type. When describing the option moneyeness, we use the criterion S/K (K/S) for call (put) option where S is the closing spot price and K is the exercise price. We define the moneyness category of an option as Deep Out-of-The-Money (DOTM) when moneyness<0.93, Out-of-The-Money (OTM) when 0.93≤moneyness<0.97, At-The-Money (ATM) when 0.97≤moneyness<1.03, In-The-Money (ITM) when 1.03≤moneyness<1.07 and Deep-In-The-Money (DITM) when moneyness≥1.07. We divide the sample into three sub-periods: Before policy (from January 03, 2011 to November 30, 2011) in column 1, announcement policy (from December 01, 2011 to June 14, 2012) in column 2 and implementation policy (from June 15, 2012 to December 31, 2013) in column 3. Column 4 and 5 of this table displays the variation following announcement and implementation of the new multiplier, respectively.

		Average trading volume by investor (in million)					Average trading value by investor (in billion KRW)				
	Money-ness	(1)	(2)	(3)	(4) = $\frac{(2)-(1)}{(1)}$	(5) = $\frac{(3)-(2)}{(2)}$	(1)	(2)	(3)	(4) = $\frac{(2)-(1)}{(1)}$	(5) = $\frac{(3)-(2)}{(2)}$
Call	DOTM	0.668	0.662	0.112	-0.8%	-83.1%	25.500	17.000	7.600	-33.2%	-55.1%
	OTM	2.198	1.614	0.358	-26.6%	-77.8%	208.300	111.500	92.400	-46.5%	-17.1%
	ATM	1.123	1.466	0.308	30.5%	-79.0%	199.900	212.000	213.100	6.1%	0.5%
	ITM	0.009	0.007	0.002	-18.0%	-78.9%	9.700	7.800	7.100	-19.3%	-9.2%
	DITM	0.001	0.001	0.000	-19.8%	-72.1%	2.000	1.900	2.200	-4.4%	-20.1%
Put	DOTM	1.172	0.617	0.138	-47.3%	-77.7%	119.800	37.200	24.400	-68.9%	-34.4%
	OTM	1.644	1.250	0.273	-23.9%	-78.2%	222.800	125.600	108.100	-43.6%	-13.9%
	ATM	1.011	1.163	0.244	15.0%	-79.0%	218.400	189.500	184.600	-13.2%	-2.6%
	ITM	0.021	0.007	0.002	-67.5%	-73.9%	20.200	7.600	5.900	-62.3%	-21.9%
	DITM	0.002	0.001	0.000	-18.7%	-86.1%	4.300	3.100	2.200	-28.8%	-29.4%

index derivatives markets (See Table 1.7 in the Appendix). Similarly, Panel B provides a picture of how trading value market reacted to the multiplier increase over the long run. There is a decrease in trading value since the announcement day (December, 2011) to February, 2017. However, this decrease appears to be smoother and less pronounced than the decrease in volumes.

Finally, all these results tend to confirm a decrease in the market share participation of individual investor's. This should results in less speculation which could improve market efficiency. However, these results are just descriptive statistics. A rigorous empirical analysis is conducted in the next section in order to confirm these intuitions.

1.6 Preliminary analysis

Before we conduct our empirical analysis, we investigate both the stationarity properties of the series as well as the relevance of the EGARCH model for estimating the conditional volatility of the KOSPI 200 option market. .

Testing for Stationarity

To investigate the order of integration of our series, we performed unit root tests for prices and returns option series. Panel A of Table 1.4 provides the results of the stationarity tests. Both stationarity tests reject the null hypothesis of non-stationarity of both prices and returns option series. According to Dickey and Fuller (1979) unit root test, the price and return series are I(0) and therefore stationary. We also performed Zivot and Andrews (2002) unit root test, which allows endogeneous detection of unit roots with breaks and thus overcomes some of the weaknesses of standard tests. The results show the absence of unit root at the 1% level. Therefore, we provide further evidence that price and return series of the KOSPI 200 options are stationary (I(0)).

Testing for linear GARCH

In order to test for the presence of conditional heteroscedasticity in the context or ARCH models, we rely on the ARCH-LM test developped by Engle (1982). Table 1.4 shows that we reject the nul hypothesis of no conditional heteroscedasticity for call and put option. Tehrefore, we conclude for the presence of an ARCH effect for both series.

Testing for nonlinear GARCH

In order to check for the presence of asymmetric GARCH effect, we use the Engle and Ng (1993) sign bias (SB) test, negative and positive size bias (NSB and PSB) tests, and a joint LM test. The

SB test examines the possibly asymmetric impacts that shocks of different sign have on volatility. The NSB (PSB) test investigates the possibly different impacts that negative (positive) shocks of different magnitude have on volatility.

Panel B in Table 1.4 shows the results for the various tests. In particular, the joint LM test of no asymmetry does not reject the presence of non linear ARCH effect. Therefore, the choice of an EGARCH model appears to be relevant.

Table 1.4: Preliminary analysis

This table provides preliminary analysis for KOSPI 200 call and put options. We use nearest the money options with 35 days to expiration to standardize a large number of maturities and exercise prices. Prices denotes closing prices and returns denotes the log returns computed as $returns = ln(closing_t - closing_{t-1})$. The sample period extends from January 3, 2011 to December 31, 2013 (743 trading days). All the data are daily. Panel A provides the Augmented Dickey-Fuller (ADF) test and Zivot-Andrews test (ZA) test for unit root. τ, τ_μ and τ_t correspond to the test statistics of the ADF test without a constant, with a constant and with a constant and trend respectively. The ZA test is the minimum Dickey-Fuller statistic allowing for one structural break in intercept ($ZA_{intercept}$), trend (ZA_{trend}) or both ($ZA_{intercept,trend}$). Break date denotes the date on which the minimum DF statistic is obtained. Panel B provides ARCH-LM test, Sign Bias test (SB) Negative Sign Bias test (NSB), Positive Sign Bias test (PSB) and the joint test (Non linear ARCH). ARCH-LM denotes Engle's LM test statistics. SB test statistics is the t-statistic for the coefficient on S_t^- which takes the value of one when the squared standardized residuals $\hat{\varepsilon}_{t-1}$ is negative and zero otherwise. NSB is the t-statistic for the coefficient on $S_t^- \hat{\varepsilon}_{t-1}$ and PSB is the t-statistic for the coefficient on $S_t^+ \hat{\varepsilon}_{t-1}$. Non linear ARCH denotes F-statistic of the joint test.

Panel A: Test of unit root

		Prices		**Returns**	
		Call	**Put**	**Call**	**Put**
ADF	τ	-0.755	-0.815	-14.029***	-14.392***
	τ_μ	-2.509	-2.545	-14.020***	-14.384***
	τ_t	-3.513**	-3.615 **	-14.036***	-14.414***
ZA	$ZA_{intercept}$	-5.471***	-5.452***	-19.897***	-22.182***
	Break date	Jul. 27, 2011	Jul. 11, 2011	Sep. 28, 2011	Sep. 13, 2012
	ZA_{trend}	-5.672	-5.213	-19.824***	-22.130***
	Break date	Aug. 22, 2011	Aug. 10, 2011	Feb. 7, 2012	Sep. 1, 2011
	$ZA_{intercept,trend}$	-7.145***	-6.866***	-19.906***	-22.191***
	Break date	Nov. 28, 2011	Nov. 24, 2011	Sep. 28, 2011	Aug. 12, 2011

Panel B: Test for ARCH effect

Linear GARCH	ARCH-LM	51.950***	65.667***	52.764***	35.099 ***
Non-linear GARCH	SB	-2.436***	-0.287	-0.005	0.011*
	NSB	0.019	0.049	0.100**	0.251***
	PSB	0.247***	0.267***	0.275***	0.061
	Joint LM test	8.47***	3.47**	24.47***	14.17***

*, **, *** denote significant at the 10%, 5%, and 1% levels, respectively.

1.7 Empirical results

In this section, we investigate weather the KOSPI 200 market options have reacted to multiplier increase using a slightly changed EGARCH (1,1) model. We first address an analysis of the announcement effect on the conditional volatility since we believe that market players base their decisions on rational expectations. Consequently, the announcement of such a policy may affect the behavior of the individual agents and hence the market itself. Secondly, we assess how the multiplier increase implementation affects the asymmetric volatility. As shown in the Figure 1.4, the noise traders participation has reduced into KOSPI 200 market options. Therefore, the level of speculation should decrease which could result in a more efficient market.

Announcement effect

Table 1.5 shows the results of the EGARCH model. In order to take into account the effect of the multiplier increase announcement on volatility for call and put options, we introduce a dummy that takes the value of 1 on December 1, 2011 which corresponds to $w1$ parameter in Table 1.5. For call options (column 1), the parameter is not significant even at 10% level. It shows that market players did not react negatively to the announcement keeping the market relatively stable. This result reflects roughly the same feeling regarding Figure 1.4 about call options. Indeed, the graph shows a decrease at the time of the announcement but which is very soft, especially with regard to put options. For put options (column 2), the coefficient $w1$ of the announcement effect is positive and significant at 5% level. It shows that market players do react negatively to the announcement which destabilize the market by inducing a higher volatility. This reflects the sharp decline at the time of the announcement, as shown in Figure 1.4 for put options.

Asymmetry before multiplier increase

In order to assess how the multiplier increase implementation affects the level of asymmetric volatility for call and put options, we introduce two dummies variables which corresponds to α_1 and α_2 parameters in Table 1.5. The first dummy captures the asymmetric volatility before the multiplier increase and is equal to 1 before June 15, 2012 and zero otherwise. The second one captures the asymmetric volatility after the multiplier increase and is equal to 1 after June 15, 2012 and zero otherwise. Both coefficients α_1 and α_2 are significant at 5% level. The results confirms the asym-

metric effect into the KOSPI 200 market options (call and put) before and after the multiplier increase.

However, some differences appear between call and put options. Call options show a positive and significant coefficient α_1 at 5% level. This result is somewhat contre-intuitive since positive shocks lead to a higher conditional variance than negative shocks of the same magnitude. This result could be due to the overreaction to the market signal from some options buyers in the Korean market. Indeed, uninformed traders (noise traders) tend to overly buy call options in response to a positive return shock, and this causes the additional increase of the call prices, leading to an increase of the implied volatility. If the magnitude of this increase is larger than that of the decrease caused by the positive return shock, then the net effect we observe is an increase of the volatility in response to the positive return shock. Therefore, this unique pattern observed in the Korean market is due to the characteristics of the KOSPI 200 options market and the trading behavior in the Korean financial market. Among market practitioners, it is widely believed that, in the KOSPI 200 options market, domestic individual investors tend to regularly and overly buy options and overreact in response to positive news of the underlying market. Further, the existence of special options accounts makes buying KOSPI 200 options easier to implement than writing them. Since early in the history of the KOSPI 200 options market, the KRX has promoted options trading by inducing individual investors to open special accounts that prohibit them from writing options, instead of requiring relatively lower levels of margin accounts. Given that noisy individuals with little wealth and trading experience prefer using the special accounts, they are even more likely to overreact and be affected by the behavioral biases. Put options show a significant and negative coefficient α_1 at 5% level. This result is consistent with asymmetric volatility theories (i.e., sharply increased volatility in response to a negative shock). The direction of the volatility change is intuitive since negative shocks lead to a higher conditional variance than positive shocks of the same magnitude. Therefore, traders might overly buy put options when they face a negative return shock, leading to an additional increase of the put prices and increased implied volatility.

Asymmetry after multiplier increase

In order to assess if the multiplier increase improved the market efficiency (level of asymmetry), we compare α_1 and α_2 parameters. α_1 shows the asymmetry level before the policy implementation while α_2 gives the asymmetry level after the policy implementation. The comparison of both coefficients allows us to confirm that the asymmetry has decreased for both call and put options, as

Table 1.5: estimation results

This table presents estimation results of the augmented AR(1)-EGARCH(1,1) models for call and put KOSPI 200 options. Augmented AR(1)-EGARCH(1,1) model is defined as $r_t = \mu + r_{t-1} + \varepsilon_t$ and $ln(\sigma_t^2) = \omega_0 + \omega_1 \mathring{A}_t + \alpha_1 M_{t-1}^{Before} Z_{t-1} + \gamma_1 M_{t-1}^{Before}(|Z_{t-1}| - E(|Z_{t-1}|)) + \alpha_2 M_{t-1}^{After} Z_{t-1} + \gamma_2 M_{t-1}^{After}(|Z_{t-1}| - E(|Z_{t-1}|)) + \beta_1 ln(\sigma_{t-1}^2) + \mu_t$. M1 in column (1) of the table provides the results of the model with multiplier effect only. M2 in column (2) of the table provides the results of the model with announcement and multiplier effect only. ARCH-LM(5) judges whether there is an ARCH effect on the residuals at the 5th time difference.

	Parameter	**Call (1)**	**Put (2)**
Mean equation	μ	0.0168**	-0.0011
		(2.04)	(0.16)
	r_{t-1}	-0.4304***	-0.3567***
		(-12.18)	(-10.16)
Variance equation	ω_0	-1.9266***	-3.6024***
		(-3.38)	(-4.67)
	ω_1	0.041	0.3475**
		(0.66)	(2.60)
	α_1	0.1636***	-0.1903*
		(2.48)	(-2.80)
	γ_1	0.4028***	0.3635***
		(3.88)	(4.52)
	α_2	0.1096**	-0.1320*
		(1.97)	(-1.84)
	β_1	0.4961**	0.0530
		(3.01)	(0.24)

t-statistics are in (); *, **, *** denote significant at the 10%, 5%, and 1% levels, respectively.

a result of the new KRX policy reform. In the case of call options, we find that asymmetry is about 0,16 and 0,10 before (α_1) and after (α_2) policy implementation, respectively. This is a reduction of asymmetry of about 0.06 unit thanks to the multiplier increase. In the same vein, asymmetry for put options is about 0.19 (α_1) and 0.13 (α_2) before and after policy implementation. It corresponds to a decrease of 0.06 unit also. This decrease of asymmetry is in full harmony with the decline in the share of uninformed investors (see Table 1.2 and Figure 1.4) as a result of the rise in the trading multiplier. The objective of limiting speculation and improving market stability by implementing a completely new policy that is completely at the opposite of what is usually being done in financial market place is bearing fruit.

1.8 Conclusion

In this paper, I empirically assessed the effectiveness of the multiplier increase policy on two measure of market efficiency: (i) the share of individual investors and (ii) asymmetric volatility over January 3, 2011, to December 31, 2013 period. I find that investment of individual investors sharply dropped, therefore successfully meeting the Korean authority objective. I also find that asymmetric volatility also declined in KOSPI 200 call and put option markets after the policy reform. All these results confirm the success of the multiplier increase in limiting speculative activities from individual investors (noise traders) and improving market stability.

The KRX is the first stock exchange to undertake a multiplier increase to regulate the financial market worldwide and it is bearing fruit. Usually, this policy tool is used in the opposite sens: a decrease in the multiplier. Our study highlights the effectiveness and encourage implementation of a such policy that can be replicated for other highly speculative markets.

1.9 Appendix

Table 1.6: KOSPI 200 Options Daily Trading Average Volume and proportions by type of trader

			2011											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	**Nov**	**Dec**
Call	**Individuals**	vol	2.482	2.821	2.801	2.97	2.978	2.669	2.296	3.023	2.589	1.787	**1.988**	**1.516**
		%	(32.7)	(32.6)	(31.9)	(33.7)	(31.8)	(32.5)	(32.2)	(32.0)	(31.8)	(30.8)	**(26.2)**	**(26.0)**
	Institutions	vol	2.529	2.592	3.050	3.075	3.225	2.481	2.432	2.983	2.513	1.775	**2.271**	**1.717**
		%	(33.3)	(29.9)	(34.8)	(34.8)	(34.5)	(30.2)	(34.1)	(31.6)	(30.8)	(30.6)	**(29.9)**	**(29.5)**
	Foreigners	vol	2.472	2.821	2.801	2.970	2.978	2.669	2.296	3.023	2.589	1.787	**1.988**	**1.516**
		%	(32.6)	(35.9)	(32.0)	(30.8)	(32.9)	(36.3)	(32.6)	(35.3)	(36.6)	(37.6)	**(43.0)**	**(43.5)**
	Total	vol	7.584	8.653	8.760	8.814	9.342	8.191	7.124	9.434	8.138	5.798	**7.588**	**5.816**
Put	**Individuals**	vol	2.386	3.067	2.507	2.906	2.883	2.307	2.298	1.930	1.729	1.606	**1.728**	**1.271**
		%	(33.3)	(35.5)	(33.5)	(33.0)	(32.9)	(33.6)	(33.6)	(30.7)	(32.2)	(29.7)	**(26.3)**	**(27.3)**
	Institutions	vol	1.928	1.845	2.081	2.533	2.235	1.623	1.833	1.546	1.234	1.329	**1.480**	**1.149**
		%	(26.9)	(21.3)	(27.8)	(27.7)	(25.5)	(23.7)	(26.8)	(24.6)	(22.9)	(24.5)	**(22.5)**	**(24.7)**
	Foreigners	vol	2.724	3.618	2.778	3.301	3.573	2.861	2.623	2.737	2.364	2.422	**3.292**	**2.183**
		%	(38.0)	(41.9)	(37.1)	(37.5)	(40.8)	(41.7)	(38.4)	(34.6)	(44.0)	(44.8)	**(50.2)**	**(47.0)**
	Total	vol	7.151	8.629	7.474	8.801	8.752	6.846	6.828	6.272	5.368	5.403	**6.554**	**4.645**
			2012											
Call	**Individuals**	vol	1.638	1.582	1.316	1.574	**1.474**	**1.133**	0.418	0.417	0.382	0.359	0.316	0.312
		%	(26.4)	(27.8)	(30.3)	(28.0)	**(24.7)**	**(26.6)**	(26.9)	(27.4)	(27.0)	(27.0)	(28.4)	(28.4)
	Institutions	vol	1.910	1.743	1.177	1.823	**2.015**	**1.520**	0.512	0.470	0.457	0.404	0.332	0.332
		%	(30.8)	(30.6)	(27.1)	(32.4)	**(33.8)**	**(35.7)**	(33.0)	(30.9)	(32.3)	(30.4)	(29.8)	(30.2)
	Foreigners	vol	1.638	1.582	1.316	1.574	**1.474**	**1.133**	0.418	0.417	0.382	0.359	0.316	0.312
		%	(41.9)	(40.5)	(41.5)	(38.6)	**(40.5)**	**(36.8)**	(39.0)	(40.9)	(39.98)	(41.8)	(41.0)	(40.8)
	Total	vol	6.193	5.684	4.339	5.612	**5.950**	**4.248**	1.550	1.520	1.412	1.329	1.110	1.100
Put	**Individuals**	vol	1.500	1.550	1.369	1.387	**1.435**	**1.055**	0.368	0.349	0.330	0.325	0.284	0.280
		%	(28.0)	(27.6)	(28.9)	(28.5)	**(26.4)**	**(28.3)**	(29.7)	(28.3)	(27.8)	(28.1)	(28.5)	(28.1)
	Institutions	vol	1.358	1.477	1.070	1.184	**1.205**	**1.043**	0.304	0.302	0.294	0.270	0.252	0.269
		%	(25.3)	(26.3)	(22.6)	(24.5)	**(22.2)**	**(28.0)**	(24.6)	(24.5)	(24.8)	(23.4)	(25.3)	(27.0)
	Foreigners	vol	2.440	2.525	2.228	2.222	**2.749**	**1.590**	0.553	0.568	0.553	0.549	0.550	0.539
		%	(45.6)	(45.0)	(47.1)	(46.0)	**(50.6)**	**(42.7)**	(44.6)	(46.1)	(46.5)	(47.6)	(45.3)	(44.1)
	Total	vol	5.351	5.601	4.722	4.823	**5.426**	**3.719**	1.239	1.233	1.187	1.153	0.994	0.996

Note: Volume are presented in million. Proportion of traders are in ().

Table 1.7: Global Top Ten Futures and Options Exchanges

This table displays the total trading volume of Futures and options for the top 10 stock exchange ranked by the number of contracts traded and/or cleared.

Exchange name	2009		2010		2011		2012		2013	
	Rank	Volume	Rank	Volume	Rank	Volume	Rank	Volume	Rank	Volume
Korea Exchange	1	3,102,891,777	1	3,748,861,401	1	3,927,956,666	5	1,835,617,727	9	820,664,621
CME Group (includes CBOT and Nymex)	3	2,589,555,745	2	3,080,492,118	2	3,386,986,678	1	2,890,036,506	1	3,161,476,638
Eurex (includes ISE)	2	2,647,406,849	3	2,642,092,726	3	2,821,502,018	2	2,291,465,606	3	2,190,727,275
NYSE Euronext (includes U.S. and EU markets)	4	1,729,965,293	4	2,154,742,282	4	2,283,472,810	4	1,951,376,420	2	2,807,970,132
National Stock Exchange of India	7	918,507,122	5	1,615,788,910	5	2,200,366,650	3	2,010,493,487	4	2,135,637,457
BM&FBovespa	6	920,375,712	6	1,422,103,993	6	1,500,444,003	6	1,635,957,604	5	1,603,706,918
CBOE Group (includes CFE and C2)	5	1,135,920,178	7	1,123,505,008	8	1,216,922,087	7	1,134,316,703	6	1,187,642,669
Nasdaq OMX (includes U.S. and Nordic markets)	8	815,545,867	8	1,099,437,223	7	1,295,641,151	8	1,115,529,138	7	1,142,955,206
Multi Commodity Exchange of India (includes MCX-SX)	12	385,447,281	9	1,081,813,643	9	1,196,322,051	10	959,613,240	10	794,001,650
Russian Trading Systems Stock Exchange	9	474,440,043	10	623,992,363	10	1,082,559,225	9	1,061,835,904	8	1,134,477,258

Source: FIA: https://fia.org/.

Chapter 2

Capital gains tax and market quality: Evidence from the Korean market

Gunther CAPELLE-BLANCARD and Emna KHEMAKHEM

2.1 Introduction

The global financial crisis has renewed interest in the taxation of financial markets, a trend that has been fueled by a mix of tight public finances and public distrust towards the financial sector (Matheson (2011); McCulloch and Pacillo (2011)). A long-standing proposal is to impose a levy in the form of a very low tax rate to certain financial transactions. Such financial transaction taxes (FTT) are hotly debated. Broadly speaking, on the one hand, proponents of FTT claim that it would be income-generating, restrict speculative or noise trading, reduce price fluctuations and foster long-term strategies (Keynes (1936); Tobin (1978); Stiglitz (1989); Summers and Summers (1989); Kupiec (1996)); on the other hand, opponents of FTT are affraid that it will harm market efficiency and increase volatility by reducing liquidity. There is also a large empirical litterature on this topic: in the US (Pomeranets and Weaver (2018); Matheson (2014)), in Europe (Umlauf (1993); Saporta and Kan (1997); Capelle-Blancard and Havrylchyk (2016); Capelle-Blancard (2017); Colliard and Hoffmann (2017)) or in Asia (Hu (1998); Baltagi et al. (2006); Chou and Wang (2006); Liau et al. (2012)). Overall, empirical studies find a negative effect on market volume, but no clear impact on market liquidity or volatility.

Most of the FTTs are similar to stamp duties and are levied on share purchases. However, with the the large and growing size of derivatives markets, there is a growing support for extend taxation.

Some FTT on derivatives markets exist, in Taiwan or Italy for instance, but it is fairly rare. Taxing derivatives is not as straightforward as taxing equities, because the tax base is more difficult to assess (Persaud (2012)). A solution might be to tax, not transactions, but capital gains realised from derivatives. In this paper, we examine the impact of such capital gains tax (CGT) on the derivatives market: to the best of our knowledge, our study is the first of its kind. [1]

After a lively debate on whether there were too much trading on the Korean derivatives market and whether, as a result, this market should be taxed, the Korean Government decided in 2016 to tax KOSPI 200 futures and options. The stated goals of this tax reform were to secure tax revenue and to restrict speculative demand by individual investors. Initially, the Korean Government planned to introduce a FTT, but they finally opted for a CGT. Since the Korean market is one of the most important derivatives market in the world, it provides us both a unique and a relevant framework.

The contribution of this paper is enhanced by the specific organisation of the Korean derivatives market, which – incidentally – gives us the opportunity to carry out a rigorous causal analysis. This study is based on three key ingredients. i) The design of the Korean CGT on derivatives is unique: it is not based on the amount of the transaction (tricky to define in the case of derivatives), but on capital gains. ii) When the Korean Government decided to tax KOSPI 200 derivatives, it focused on the "regular" KOSPI 200 contracts but completely ignored Mini KOSPI 200 contracts, which are very similar however. Actually, Mini KOSPI 200 derivatives were subject to the CGT six months later. This time delay provides us with a meaningful quasi-natural experiment. iii) The Korean derivatives market is characterised by a very high proportion of individual investors, which gives us the opportunity to test the impact of taxation on speculative trading.

This paper assess the impact of the taxation of KOSPI 200 derivatives on various measure of market liquidity: trading volume, trading value, and bid-ask spread. Our sample consists of the futures and options contracts KOSPI 200 and Mini KOSPI 200 from August 2015 to December 2016. During this period, initially, neither the KOSPI 200 nor the Mini KOSPI 200 was taxed (August 2015-December 2015). Then, from the 1st of January 2016, a 10% CGT has been applied to income arising from transactions on KOSPI 200 futures and options, while the tax did not applied to Mini KOSPI 200. Finally, on July 2016, the Mini KOSPI 200 has been added to the tax system. This 6-month delay between the taxation of the KOSPI 200 and the Mini KOSPI 200 is totally ad hoc. Therefore, we have two quasi-natural experiments that are very suitable for Difference-in-

1. Theoretical models of securities market with capital gains tax include the seminal contributions of Constantinides (1983) and Stiglitz (1989), and more recently, Fischer and Gallmeyer (2016). Empirically, the impact of capital gains tax on stock market has been investigated by Noronha and Ferris (1992) and Dai et al. (2013) for the US, as well as Hayashida and Ono (2010) for Japan.

Differences (DiD) analysis: first, we consider the first two periods (August 2015-June 2016) and we use KOSPI 200 contracts as a treated group and Mini KOSPI 200, which were not taxed, as a control group; Second, we consider the last two periods (January 2016-December 2016) and we use Mini KOSPI 200 as a treated group and KOSPI 200 contracts, which were already taxed, as a control group. To ensure the reliability of our results, we also consider the market activity on the KOSPI stock index, which is not submitted to the CGT. In addition, in order to investigate whether the tax affect the composition of trading activity, we analyse the market share by trader type: individuals, institutions and foreigners; only individuals are subject to the tax.

The results of the DiD analysis show that the introduction of the Korean CGT reduced the volume and the value of transactions, but it had no significant effect on the bid-ask spread. A closer look at the activities of the different types of traders shows a shift in trading activity from individual investors to institutional traders (which are exempted) and from the KOSPI 200 to the Mini KOSPI 200 derivatives.

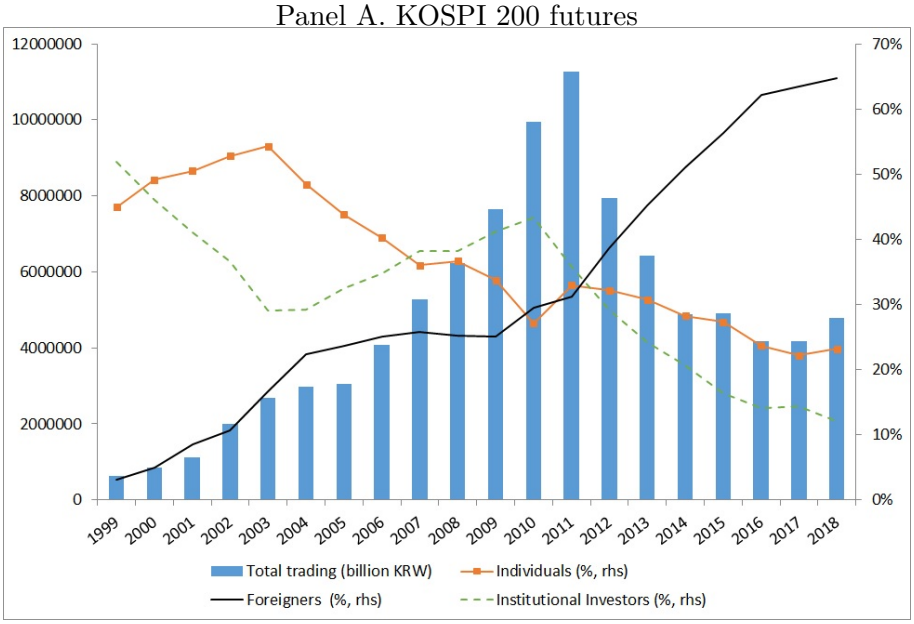
The remainder of this paper is organized as follows. Section 2.2 describes the Korean market, details the tax reform and briefly surveys the previous literature on the KOSPI derivatives market. Section 2.3 presents the data and the empirical strategy. Section 2.4 comments the main results of the DiD analysis. Section 2.5 concludes.

2.2 The derivatives market in Korea

2.2.1 The Korea Exchange and the KOSPI 200 derivatives

The Korea Exchange (KRX) is the only securities exchange operator in South Korea. Under the Korea Stock & Futures Exchange Act in 2005, KRX was created through the integration of the Korea Stock Exchange (initially established in March 1956), the Korea Futures Exchange and the Kosdaq Stock Market. The business divisions of Korea Exchange are: the Stock Market Division, the Kosdaq Market Division and the Derivatives Market Division. KRX operates the centralized securities (stocks and bonds) and derivatives markets from 09:00 am to 03:30 pm (normal trading sessions) on all business days; it is a fully electronic limit order market without floor traders and all the products are traded on the common platform, EXTURE+. As of January 2015, Korea Exchange had more than 2,000 listed companies with a total market capitalization larger than US$1 trillion. It was the 15th largest financial market in the world in terms of market capitalization.

Panel A. KOSPI 200 futures



Panel B. KOSPI 200 options

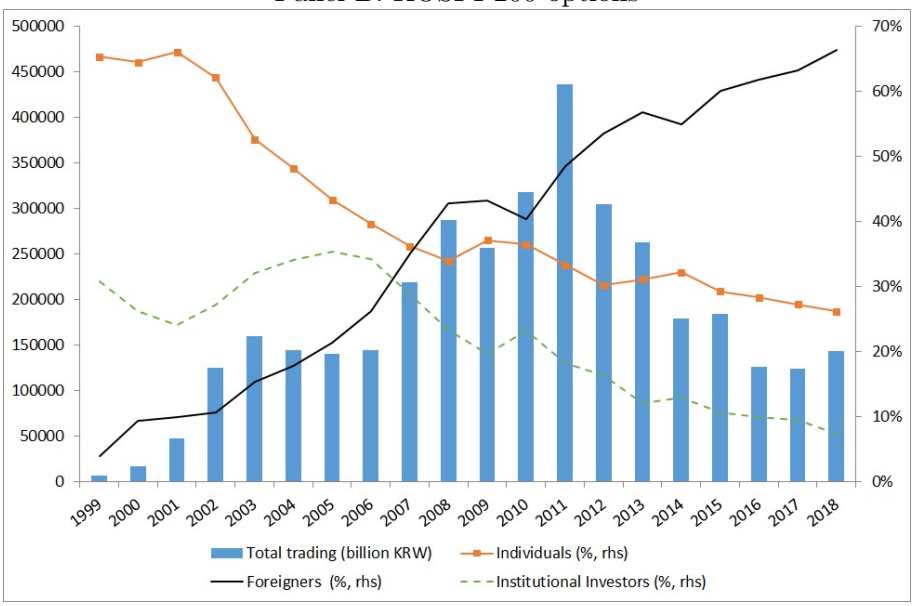


Figure 2.1: Trading value and proportion of investors by category for KOSPI 200 derivatives

The Korean derivatives market is one of the world's largest derivatives markets, consistently ranked among the Top 10 by all criteria. This market is highly concentrated on a few products, mainly equity index derivatives based on the Korea Composite Stock Price Index (KOSPI), established in 1964, and which comprise the top 200 listed stocks.

KOSPI 200 index futures and options were first listed in May 1996 and July 1997, respectively. Since then, they account for about 90% of the trades. The evolution of the trading value over the last twenty years is displayed in Figure 2.1. [2] There are clearly two distinct sub-periods. In the 2000s, the Korean derivatives market grew dramatically: In 1999, the trading amount in the KOSPI 200 derivatives was just around KRW 627,710 billion (approx. $500b) for futures and KRW 7,129 billion ($6b) for options; In 2011, the trading amount rose to KRW 11,260,000 billion ($10,000b) for futures and KRW 436,326 billion ($400b) for options. Accordingly, over the period, the average annual growth rate of KOSPI 200 derivatives was more than 27%, while in comparison the average growth rate in the equity spot market was around 12%. [3] Since then, market activity has gradually decreased by half. In 2018, the trading amount in the KOSPI 200 futures was KRW 4,788,500 billion ($4,350b).

In July 2015, Mini KOSPI 200 futures and options has been introduced. These products are the same as KOSPI 200 derivatives, but they can be traded in smaller volume, starting from KRW 100,000, while the "standard" KOSPI 200 derivatives contracts can be traded at a minimum of KRW 500,000. In the following of the paper, we take advantage of the coexistence of these two different, but closely related, contracts to examine the impact of the CGT on market activity. [4]

2.2.2 Individual investors in Korea

One of the main characteristics of the Korean derivatives market is the importance of individual investors. [5] KRX publishes detailed information on the transactions carried out by each category of investors: Individuals, Foreigners and Institutional Investors [6] – it should be noted that such information is rarely communicated by the other derivatives markets. The proportion for each categories is represented in Figure 2.1, along with the total trading value.

Unlike the main derivatives markets, where individuals account for less than 10% of the transactions,

2. The statistics used in this section are provided by KRX on its website.

3. In the 2000s, the KOSPI 200 futures contract was ranked first in the world in terms of the number of contracts traded, but it was mainly due to the small size of the contract that artificially inflated the volumes. For the same reason, CNX Nifty Options, proposed by the National Stock Exchange of India, is regularly promoted as the number 1 equity derivatives contract in the 2010s, although its actual prevalence is less than that of S&P index derivatives for instance.

4. In 2009, KOSPI 200 futures commenced CME-linked trading, and in 2010 KOSPI 200 option-linked Eurex trading began.

5. According to the Korean Statistical Information Service, the ratio of the population investing in the stock markets to the total population increased from 7.8% to 10.1% from 2004 to 2013 (data are no more available since). See Oh et al. (2008) for a study on the development of online investing in Korea in the 2000s.

6. This last group gathers the following sub-categories: Financial Investment, Insurance Companies, Investment Trusts, Bank, Other Financials, Pensions, Goverment and Others.

individual investors in the Korean market made up more than half of the activity of the KOSPI 200 derivatives market in the early 2000s. It has long been a source of concern for the authorities. In particular, according to a survey by the Financial Supervisory Service in 2006, reported by Park (2011), the losses accumulated by individuals from 2002 to 2005 reached KRW 2 trillion (371 billion from futures and 1,713 billion from options), mainly to the benefit of institutional and foreign investors. [7] At the same time, the strong taste for speculation by Korean individual investors has largely contributed to the growth of the KOSPI 200 derivatives market. Various measures has been taken to limit speculative transactions and although it is difficult to observe a significant downturn at any given time, there is a clear and continuous downward trend. Still, in the recent years, more than 20% of transactions have been carried out by individual investors, a much higher percentage than on other derivatives markets in the United States and Europe.

2.2.3 Financial market reforms in Korea

In order to curb excessive speculative trading of individual investors, several reforms has been introduced, mostly through non-tax policies. [8] KOSPI 200 options had initially a small contract size, compared to other index derivatives traded elsewhere. Hence, on March 2012, KRX announced the increase of KOSPI 200 option multiplier from 100,000 to 500,000 won. KRX also modified on several occasions the margin requirements. The increase of multipliers and tougher margin requirements may discourage investors from participating in the market, by increasing the cost and reducing the leverage. Individual investors are more prone to be impacted by these measures because they are more likely to be active in the derivatives market for speculation and do not have the same funding capacity as institutional investors. However, there is also a risk that individual investors turn to out-of-the-money options, which are cheaper, but also more speculative. In the next subsection, we briefly survey empirical evidence on the impact of the previous regulatory reforms in the Korean derivatives market. But before, we describe the tax reform, which is specifically the purpose of the following impact assessment.

The taxation of derivatives in Korea was the result of a long process. The discussion was initiated in August 2012, when the Korean Government announced its intention to tax KOSPI 200 derivatives. Inspired by discussions in Europe in favour of a financial transaction tax (FTT) with the widest possible scope, and therefore including derivatives, the two main political groups in Korea (the

7. More precisely, Chou and Wang (2006) reports the number of winners/losers within each categories: From January to July 2004, one-third of the individual accounts record gains, while the other two-thirds record losses.

8. A chronology of the main reforms is presented in the appendix.

SAENURI Party, the ruling one, and the Democratic Party, the opposition one) have embraced this project (Jung (2013b)). Initially, the idea was to extend the securities transaction tax (STT), already in force, to derivatives. STT was first introduced in Korea in 1963 on securities, before being abolished in 1971 and, then, reintroduced in 1978. Tax authorities impose 0.15 percent per transaction on the KOSPI market, 0.3 percent when including a special tax for rural development, and 0.3 percent on the Kosdaq market. Although there has been regular calls for its abolition, the Korean STT is well established [9]: the tax revenue amounted to KRW 6.3 trillion in 2017 (4.5 for the STT + 1.8 for the rural development tax on STT), which represents, in recent years, between 1.3% and 2% of the country's total tax revenues (see Figure 2.5 in the appendix). The initial proposition of the Government was to levy a 0.001 percent tax on the value of KOSPI 200 futures contracts and a 0.01 percent tax on the premiums for KOSPI 200 option contracts. [10] The implementation of this FTT on derivatives was postponed to 2016 to enable adaptation. The objective was to raise about KRW 100 billion in tax revenue per year. However, the FTT on derivatives never came into being. [11] Instead of a FTT, the Korean Government has introduced a tax on capital gains on profits from trading certain financial derivatives.

Since January 2016, a CGT has been applied to income arising from transactions on KOSPI 200 futures and options [12]. Only the "regular" KOSPI 200 futures and options were subject to this tax, and not the Mini KOSPI 200 products, probably because they have been introduced just a few months earlier. However, in March 2016, an amendment in the tax code extended the tax base by adding Mini KOSPI 200 futures and options from July 2016. It is also important to note that only individual traders are subject to the CGT; institutional and foreigners are exempted. [13] Initially, the tax rate was 5%, but it has been increased to 10% in April 2018. [14] In July 2018, the Government has decided to expand the CGT to cover all derivatives (in particular, Kosdaq 150 futures and options and KRX 300 futures). The reason for this is to increase tax revenue to mitigate the fiscal spending due to the ageing of the population. [15]

9. Business Korea, "It's Time to Abolish Securities Transaction Tax, Korea's Top Financial Regulator Says" November 7, 2018. The opponents to the FTT claim that its repeal will boost the Korean stock market. Previous evidence show, however, that expectations in this regard are often unfulfilled (Capelle-Blancard, 2016).

10. Reuters, "S.Korea to start taxing KOSPI 200 futures, options in 2016" August 8, 2012. https://www.reuters.com/article/korea-economy-tax/s-korea-to-start-taxing-KOSPI-200-futures-options-in-2016-idUSB9E8GB01P20120808.

11. FTT on derivatives exist in Taiwan since 1998 (Chou and Wang (2006)) and Italy since 2013 (Capelle-Blancard (2017)).

12. See Presidential Decrees No. 26067 (Feb. 3, 2015) and No. 27829 (Feb. 3, 2017); Income Tax Act: Article 159-2 (Scope of Derivatives), Article 161-2 (Calculation of Gains on Derivatives); and Article 167-9 (Flexible Tax Rate of Capital Gains Tax on Derivatives).

13. See https://www.nts.go.kr/tax/tax07_popup/sub02_1_4.html.

14. Unfortunately, the amount of tax revenues from the CGT on derivatives is not publicly available.

15. Reuters, "S.Korea to impose capital gains tax on all stock derivatives" July 30, 2018.

2.2.4 Previous studies on the Kopsi derivatives market

Several academic studies have been devoted to the KOSPI 200 derivatives. Jung (2013a) provides a brief history of the derivatives market in Korea and attempts to explain the success of the KOSPI 200 derivatives market. He claims that, until 2011, the absence of tax, low transaction fee, low margin requirement and high volatility of the underlying index are the main factors explaining the high trading volume of the KOSPI 200 options. Moreover, he suggests that proportion of individual investors are also contributing factors that have differentiated the Korean derivatives market from other competing exchanges. This statement is supported by Ciner et al. (2006) who claim that trading on KOSPI 200 derivatives was mainly motivated by speculation. Kwon (2011) examine whether changes in the pre-margin requirements impact the proportion of individual investors in the KOSPI 200 options market and finds mixed results.

Guo et al. (2013) test the efficiency of the KOSPI 200 index options market and present clear evidence of violations of the martingale restriction. In the same vein, Sim et al. (2016) find that option prices often do *not* monotonically correlate with underlying prices; they also find that some violations are attributable to individual trades. [16]

Lee et al. (2015) and Kang et al. (2020) examine the role of high frequency traders (HFT) in the KOSPI 200 futures market from 2010 to 2014 (during that period, there were no capital gains or transaction tax). The two papers show that HFT exploit low-frequency traders by taking the liquidity. [17]

2.3 Data and methodology

2.3.1 The sample

Our sample contains daily data for the KOSPI 200 and Mini KOSPI 200 contracts (futures and options) as well as the KOSPI 200 spot index over the period August 2015-December 2016. For

https://www.reuters.com/article/southkorea-economy-tax/s-korea-to-impose-capital-gains-tax-on-all-stock-derivatives-idUSL4N1UQ1DM

16. This does not necessarily mean that all inefficiencies should be attributed to individuals investors. Using data from the Korean stock exchange over the period 2004-2015 (as well as data from the Taiwan Stock Exchange and the Stock Exchange of Thailand), Ülkü and Rogers (2018) show that, contrary to the prevailing view that holds individual investors' trading responsible, the Monday effect is mainly due to institutional investors' trading.

17. Other studies on the KOSPI 200 derivatives market include Kim et al. (2004) who examine volatility trading, Lee et al. (2015) who examine the price dynamics in the index derivatives markets, as well as Ahn et al. (2008) and Ryu (2015) who examine informed trading in KOSPI 200 index options.

each day, we have the opening and closing prices, the volume, the trading value, the highest and lowest prices, and the number of open interest.

We also have granular data in our sample, which allows us to go further in our analysis. Two features of our data set are useful. First, it provides us with a classification of investors into three groups: individuals, institutions, and foreigners. Second, our data allows us to classify trading activity of options contracts with respect to moneyness and maturity. To describe the moneyness of options in this paper, we use the ratio of spot price divided by the strike price $M = S/K$ ($M = K/S$) for call (put) options. An option is considered to be out-of-the-money (OTM) when $M < 0.975$, in-the-money (ITM) when $M > 1.025$ and at-the-money (ATM) when $0.975 \leq M \leq 1.025$. An option contract is classified as short if it is less than 30 days before expiration, medium if it is between 30 and 60 days before expiration, and long if it is more than 60 days before expiration. All the data are provided by the KRX.

Tables 2.1 and 2.2 provide summary statistics of our data. Table 2.1 shows statistics for the whole sample for the spot, the futures, and the options. Note that the market share of individual investors is particularly high compared to other derivative markets (US or Europe). Table 2.2 provides summary by moneyness and term to expiration.

2.3.2 The Difference-in-Differences approach

In order to investigate the post-tax changes in the derivative products, we rely on a generalized version of the DiD method (Card and Krueger, 2000; Bertrand et al., 2004; Abadie, 2005). In the DiD analysis, the sample is divided into the treated group and the control group. The following econometric model is then estimated:

$$Y_{i,t} = \alpha + \beta_1 * time_t + \beta_2 * CGT_i + \beta_{12} * time_t * CGT_i + \varepsilon_{i,t}$$

In the analysis, the dependent variable, $Y_{i,t}$ is a measure of market liquidity for index i at day t. The first dummy variable, $time_t$, has a value of 1 for the period after the introduction of the capital gains tax, and 0 for the previous period. For the second dummy variable, CGT_i, takes a value of 1 if the contract is taxed and zero otherwise. The third variable, $time_t * CGT_i$, is used to test the cross-effect as the product of two dummy variables. α and $\varepsilon_{i,t}$ denote the constant and residual terms of the DiD analysis respectively. The coefficient of interest is β_{12} measure the impact of the introduction of the capital gains tax. Time dummy variables capture all other changes in the

Table 2.1: Descriptive statistics of the sample (1/2)

This table provides descriptive statistics for the spot KOSPI 200 Index, the KOSPI 200 futures and options (call and put options). The sample period extends from August 2015 to December 2016 (349 trading days). All the data are daily. $C_{i,t}$ represents the closing price of contract i on the day t. $V_{i,t} = ln(Trading\ volume)$ and $TV_{i,t} = ln(Trading\ value_{i,t})$ measure the logarithm of trading volume and trading value (in KRW) respectively. $OI_{i,t}$ is the number of open interests. $VOI_{i,t} = (tradingvolume_{i,t}/OI_{i,t})$ measure the volume to Open interest ratio. Corwin-Schultz bid-ask spread, $ECS_{i,t} = 100 * (2 * (exp(\alpha_t) - 1))/((1 + exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3 - 2\sqrt{2}) - \sqrt{(\beta_{12i,t})/(3 - 2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\beta_{12i,t} = max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t})$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. Abdi & Ranaldo bid-ask spread, $EAR_{i,t} = 100 * (2 * E(C_{i,t} - \eta_{i,t})(C_{i,t} - \eta_{i,t+1}))$ with $\eta_{i,t} = (h_{i,t} - l_{i,t})/2$. Spreads are expressed as a percentage.

Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
Spot index					
$C_{i,t}$ (KRW)	349	245.61	9.35	221.53	262.59
Volume	349	7.71e+07	2.24e+07	4.39e+07	1.90e+08
Value (KRW)	349	3.26e+12	6.76e+11	1.92e+12	6.42e+12
$V_{i,t}$	349	18.12	0.26	17.60	19.06
$TV_{i,t}$ (KRW)	349	14.98	0.20	14.47	15.67
$ECS_{i,t}$ (%)	188	0.39	0.28	0.01	2.66
$EAS_{i,t}$ (%)	257	0.88	0.69	0.02	3.64
KOSPI 200 futures					
$C_{i,t}$ (KRW)	349	245.72	9.21	220.70	262.05
Volume	349	1.26e+05	4.84e+04	2.93e+04	4.82e+05
Value (KRW)	349	1.54e+13	5.63e+12	3.79e+12	6.08e+13
$OI_{i,t}$	349	1.33e+05	1.84e+04	9.04e+04	2.10e+05
$V_{i,t}$ (log)	349	11.68	0.33	10.28	13.09
$TV_{i,t}$ (log, KRW)	349	16.49	0.31	15.15	17.92
$VOI_{i,t}$	349	0.96	0.38	0.21	3.17
$ECS_{i,t}$ (%)	185	0.38	0.29	0.01	2.58
$EAS_{i,t}$ (%)	258	0.87	0.72	0.01	4.25
Individuals share (%)	349	25.48	4.35	8.14	35.47
Mini KOSPI 200 futures					
$C_{i,t}$ (KRW)	349	245.40	9.17	220.74	261.30
Volume	349	3.19e+04	1.21e+04	5.65e+03	1.16e+05
Value (KRW)	349	7.84e+11	3.02e+11	1.37e+11	2.81e+12
$OI_{i,t}$	349	2.09e+04	1.36e+04	1.53e+03	5.92e+04
$V_{i,t}$ (log)	349	10.30	0.39	8.64	11.66
$TV_{i,t}$ (log, KRW)	349	13.50	0.40	11.83	14.85
$VOI_{i,t}$	349	2.36	2.03	0.39	17.71
$ECS_{i,t}$ (%)	184	0.38	0.28	0.00	2.54
$EAS_{i,t}$ (%)	254	0.90	0.74	0.04	4.34
Individuals share (%)	349	16.80	4.88	8.68	30.83

Continue

Descriptive statistics of the sample (2/2)

Variable	Obs.	Mean	Std. Dev.	Min	Max
KOSPI 200 options					
$C_{i,t}$ (KRW)	698	3.01	1.14	0.62	7.05
Volume	698	7.58e+05	3.89e+05	1.45e+05	2.33e+06
Value (KRW)	698	2.89e+11	1.60e+11	5.49e+10	1.87e+12
$OI_{i,t}$	698	6.02e+05	1.91e+05	2.04e+05	1.09e+06
$V_{i,t}$ (log)	698	13.42	0.48	11.89	14.66
$TV_{i,t}$ (log, KRW)	698	12.47	0.44	10.91	14.44
$VOI_{i,t}$	698	1.39	1.03	0.22	8.40
$ECS_{i,t}$ (%)	382	16.60	11.79	0.20	64.46
$EAS_{i,t}$ (%)	380	28.22	20.34	1.17	113.52
Individuals share (%)	349	28.70	2.41	22.09	35.49
Mini KOSPI 200 options					
$C_{i,t}$ (KRW)	698	3.00	1.13	0.62	6.86
Volume	698	4.23e+04	2.49e+04	3.97e+03	2.06e+05
Value (KRW)	698	3.27e+09	2.42e+09	2.84e+08	3.06e+10
$OI_{i,t}$	698	8.01e+04	5.03e+04	2.63e+03	2.97e+05
$V_{i,t}$ (log)	698	10.48	0.61	8.29	12.23
$TV_{i,t}$ (log, KRW)	698	7.90	0.63	5.65	10.33
$VOI_{i,t}$	698	0.73	0.71	0.10	6.33
$ECS_{i,t}$ (%)	381	15.34	11.19	0.02	62.07
$EAS_{i,t}$ (%)	388	26.54	20.09	0.95	122.36
Individuals share (%)	349	18.58	9.23	3.03	44.68

Table 2.2: Summary statistics by option's moneyness and maturity

This table presents the average closing prices $C_{i,t}$, trading volume, trading value and the number of open interest $OI_{i,t}$ for each moneyness and maturity category. An option contract is classified as short-term (Short) if it has fewer than 30 days to expiration, medium term (Medium) if it has between 30 and 60 days to expiration, and long-term (Long) if it has more than 60 days to expiration. OTM, ATM, and ITM refer to out-of-the-money, at-the-money, and in-the-money options, respectively. The sample period is from August, 2015 to December, 2016.

	KOSPI 200			**Mini KOSPI 200**		
Moneyness	**Short**	**Medium**	**Long**	**Short**	**Medium**	**Long**
ATM						
$C_{i,t}$ (KRW)	2.87	4.65	1.69	2.79	2.27	0.07
Volume	7,49e+04	2,17e+03	2,70e+01	3,42e+03	2,45e+02	4,00e-02
Value (KRW)	3,96e+10	2,56e+09	1,34e+08	3,99e+08	6,59e+07	1,85e+04
$OI_{i,t}$	1,41e+04	2,17e+03	6,42e+02	4,69e+03	2,34e+02	2,20e-01
ITM						
$C_{i,t}$ (KRW)	22.22	9.83	1.66	1.59	0.52	0.01
Volume	6,65e+01	1,00e+01	1,30e+00	5,18e+00	1,02e+00	0,00e+00
Value (KRW)	2,91e+08	1,04e+08	1,54e+07	3,89e+07	7,30e+06	2,72e+03
$OI_{i,t}$	4,50e+02	1,75e+02	1,59e+02	5,51e+01	3,68e+00	1,00e-02
OTM						
$C_{i,t}$ (KRW)	0.10	0.46	1.15	0.11	0.41	0.07
Volume	2,03e+04	2,55e+03	4,92e+01	1,46e+03	2,16e+02	2,70e-01
Value (KRW)	3,42e+09	7,69e+08	5,39e+07	5,16e+07	1,34e+07	2,87e+04
$OI_{i,t}$	1,85e+04	3,74e+03	1,17e+03	3,57e+03	2,41e+02	2,31e+00

regulatory and economic environment during the period that affect the treated and control groups similarly, and Treated dummy variables control for differences between the two groups that are constant over time. Several control variables can be used. However, it is not necessary here as KOSPI 200 and Mini KOSPI 200 futures and options are almost identical. In all the estimations, we set apart futures and options, but we consider together call options and put options.

The date of the introduction of the CGT is January 1, 2016 for KOSPI 200 derivatives and July 1, 2016 for Mini KOSPI 200 derivatives. Therefore, we have two quasi-natural experiments. First, we consider the period from August 2015 to June 2016 (defined as Period 1 hereafter) and we use KOSPI 200 contracts as a treated group and Mini KOSPI 200, which were not taxed, as a control group. Second, we consider the period January 2016-December 2016 (Period 2 hereafter) and we use Mini KOSPI 200 as a treated group and KOSPI 200 contracts, which were already taxed, as a control group. To ensure the reliability of our results, we also consider the market activity on the KOSPI stock index, which is not submitted to the CGT; a FTT applied on the spot market, but there is no change over our sample period. The treated and the control groups are summarized in Figure 2.2 .

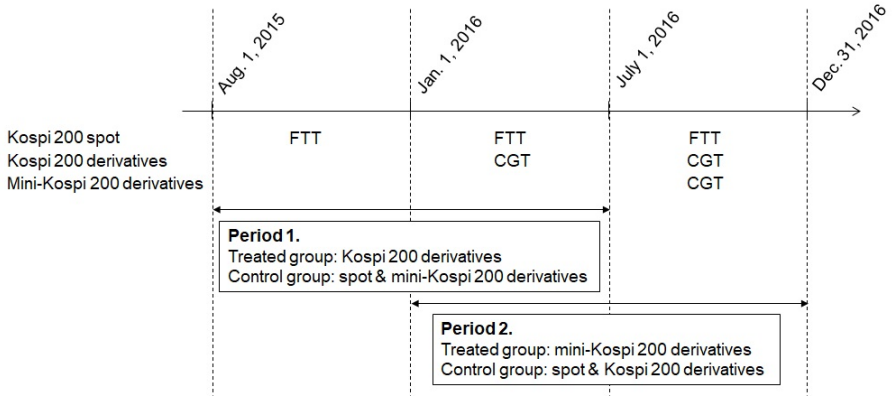


Figure 2.2: Treated and control groups for the DiD analysis.
Note: FTT and CGT denotes Financial Transaction Tax and Capital Gains Tax respectively.

2.3.3 Measuring market liquidity

To assess the impact of the CGT on derivatives, we consider several measures of market liquidity. We use three different proxies for market activity. Trading volume $V_{i,t}$ is defined as the logarithm (ln) of all contracts traded on day t; when the underlying asset is Mini KOSPI 200, the number of contracts is divided by five to facilitate comparisons. Trading value $TV_{i,t}$ is the logarithm of the market value of contract i during a trading day t in millions of KRW. We also consider the

Volume-to-open-interest ratio $VOI_{i,t}$, which is the total volume of contracts traded in a period relative to the size of open positions at the end of the period; this variable reflects the speculative behaviour for a given contract Garcia et al. (1986). [18]

Liquidity indicators that assees tightness can be grouped into two categories depending on the frequency of the data : high frequency and low frequency measures. High-frequency liquidity indicators are built from intraday data, while low-frequency liquidity indicators are mainly derived from daily stock market returns and volume data. As high-frequency liquidity measures consist of intraday trades, typically very large data samples are involved and their analysis therefore requires advanced programming and computing power. Due to these constraints, low-frequency liquidity measures are used extensively in the application. The best known of these measures are the bid-ask spread, turnover and the ratio of Amihud (2002). Although there are potential benefits, liquidity measures constructed from low-frequency data have some limitations. For example, Amihud (2002) illiquidity ratio is regarded as better suited to capture liquidity relative to most other measures (Goyenko et al., 2009), however, it does not consider non-trading days, which may contain important information on illiquidity. Also, the high-low spread that captures the transaction cost dimension of Corwin and Schultz (2012) assumes that the stock trades continuously during market opening. This assumption is violated in practice, which weakens the precision of the high-low spread. A more complete understanding of existing liquidity measures is therefore required for better application. Accordingly, liquidity proxies subsequently proposed seek to improve on the shortcomings of the previous measures. Unlike Corwin and Schultz (2012), the spread of Abdi and Ranaldo (2017) provides an adjustment for non-trading periods and does not rely on bid-ask to bounces the effective like Roll (1984). Indeed, these two last methods were used to obtain the Estimated Corwin-Schultz Spread $ECS_{i,t}$ and the Estimated Abdi-Ranaldo Spread $EAR_{i,t}$. The two measures are computed using daily data of the nearby contracts, as they are the most actively traded. $ECS_{i,t}$ and $EAR_{i,t}$ are expressed in percentage. [19]

18. Gwilym and Thomas (2002) considered that the daily change in open interest reflects more accurately the activity of hedgers than the level of open interest, because the daily change informs of net positions being opened and/or closed each day and held overnight. For this reason, they proposed a new speculative ratio as the volume divided by the absolute value of the change in the open interest $VVOI^{*}_{i,t}$. Trading value and Volume-to-open-interest ratio capture market breadth and depth.

19. It was tempting to use price impact price-impact measures, like in Capelle-Blancard and Havrylchyk (2016). However, it would have been not appropriate in our framework. Consider, for instance, the Amihud ratio which is the daily ratio of absolute return to its trading value. But prices in our control and treated groups are linked by arbitrage relationships and cannot deviate too far from each other. Consequently, the ratio would be just another proxy for trading volume.

2.4 Empirical results

2.4.1 Preliminary analysis

Figures 2.3 shows weekly volume and trading value for the KOSPI 200 and the Mini KOSPI derivatives, and the spot market. As discussed previously, KOSPI 200 derivatives are much more liquid than the spot market or the Mini KOSPI 200 derivatives. However, whatever the variable of interest, before the introduction of the tax, the contracts show parallel trends. This observation allows us to make the hypothetical assumption that the variables of interest would have continued these trends if the tax had not been applied. After the introduction of the CGT in January 2016 (delimited with the first vertical line), it seems that the gap in trading value as narrowed. But then, in June 2016 (which corresponds to the second vertical line), the reverse happened. Despite this, throughout the period, the bid-ask spread estimated with the Corwin and Schultz (2012) or Abdi and Ranaldo (2017) methods remain as closely linked as before. Therefore, *a priori*, it seems that the CGT has negatively impacted trading activity, but without impairing bid-ask spread. Of course, these preliminary results have to be rigorously confirmed.

2.4.2 DiD results

This section outlines the estimates of the tax's effects, based on our DiD analysis over a one-year period. Table 2.3 show the results of the estimated model for KOSPI 200 and Mini KOSPI 200 contracts. The first two columns of the table captures the effect of the introduction of the CGT on KOSPI 200 contracts on January 01, 2016 (compared to the spot and the Mini KOSPI), whereas the last two columns show the effect of the extension of the CGT to Mini KOSPI 200 contracts on July 01, 2016 (compared to the spot and the KOSPI). [20]

Results confirm our expectations that the trading volume of KOSPI 200 futures an options contracts decreased significantly after the introduction of the CGT, while, the variation in the volume of mini-contracts increased significantly. [21] These results are the same for the trading value. Indeed, the Korean tax has significantly lowered trading activity. In addition, there has been a significant decline in speculative activity measured by the volume to open interest ratio for both taxed and non-taxed contracts (see Table 2.5 in the Appendix), but the net effect is less significant in the case

20. Empirical averages before and after the introduction of the CGT on KOSPI derivatives (Period 1), and before and after its extension to Mini KOSPI derivatives (Period 2) are provided in the Appendix (Tables 2.5 and 2.6).

21. These results are consistent with previous studies by Noronha and Ferris (1992) that the introduction of a capital gains tax has a negative effect on trading volume.

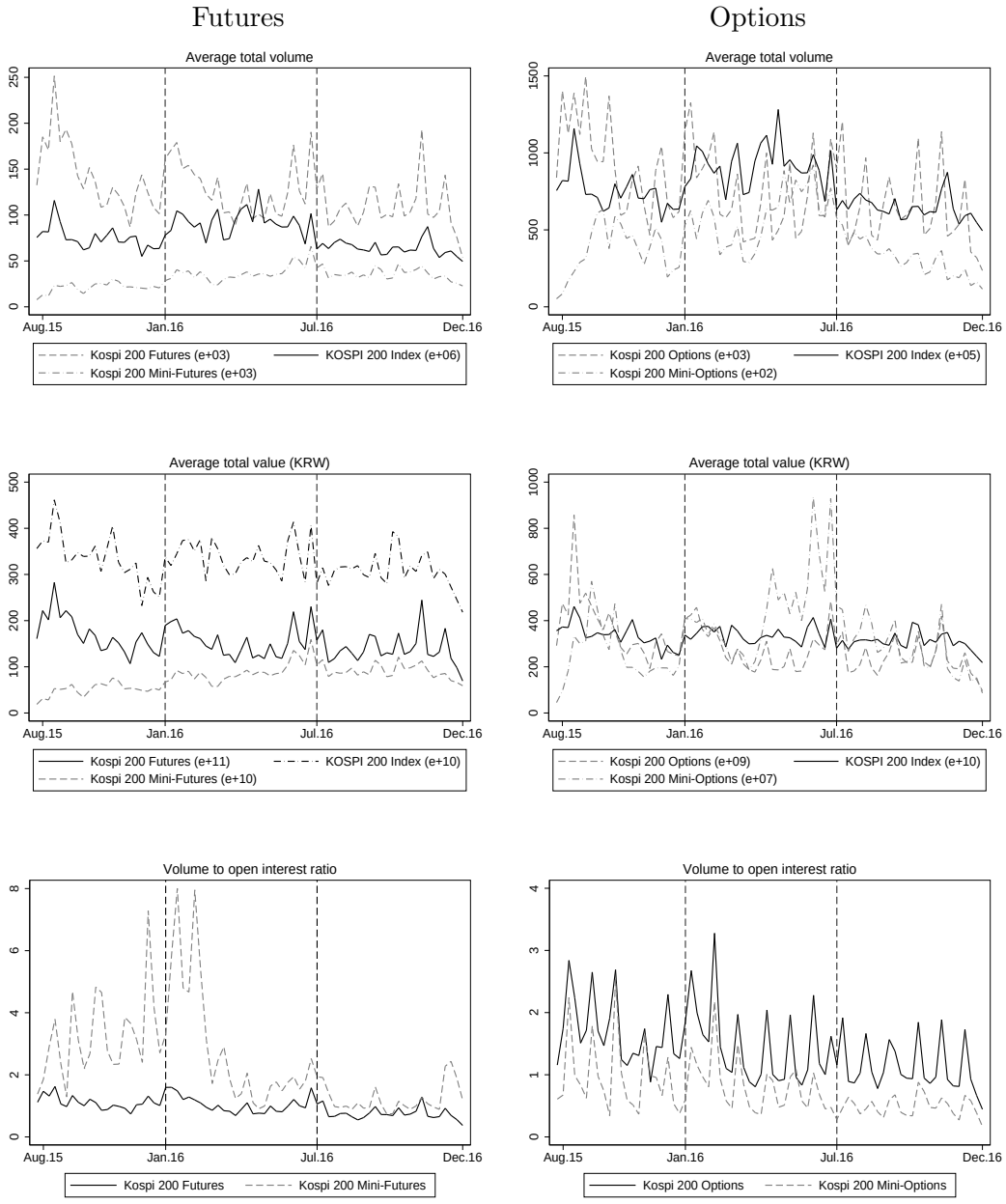


Figure 2.3: Kopsi 200 and Mini KOSPI 200 derivatives: Volume, trading value, and open interest ratio.

These figures show the weekly evolution of trading volume, the trading value and the volume to open interest ratio of Kopsi 200 spot index, Kopsi 200 and Mini KOSPI 200 derivatives between August 01, 2015 and December 31, 2016. The first vertical line corresponds to the introduction of the capital gains tax for the KOSPI 200 derivatives on January 01, 2016 and the second one to its extension to the Mini KOSPI 200 derivatives on July 01, 2016.

of futures contracts. Table 2.3 examines the trading costs and the results suggest that the impact of the tax on the spread is, at best, very limited since there is no significant change in the bid-ask

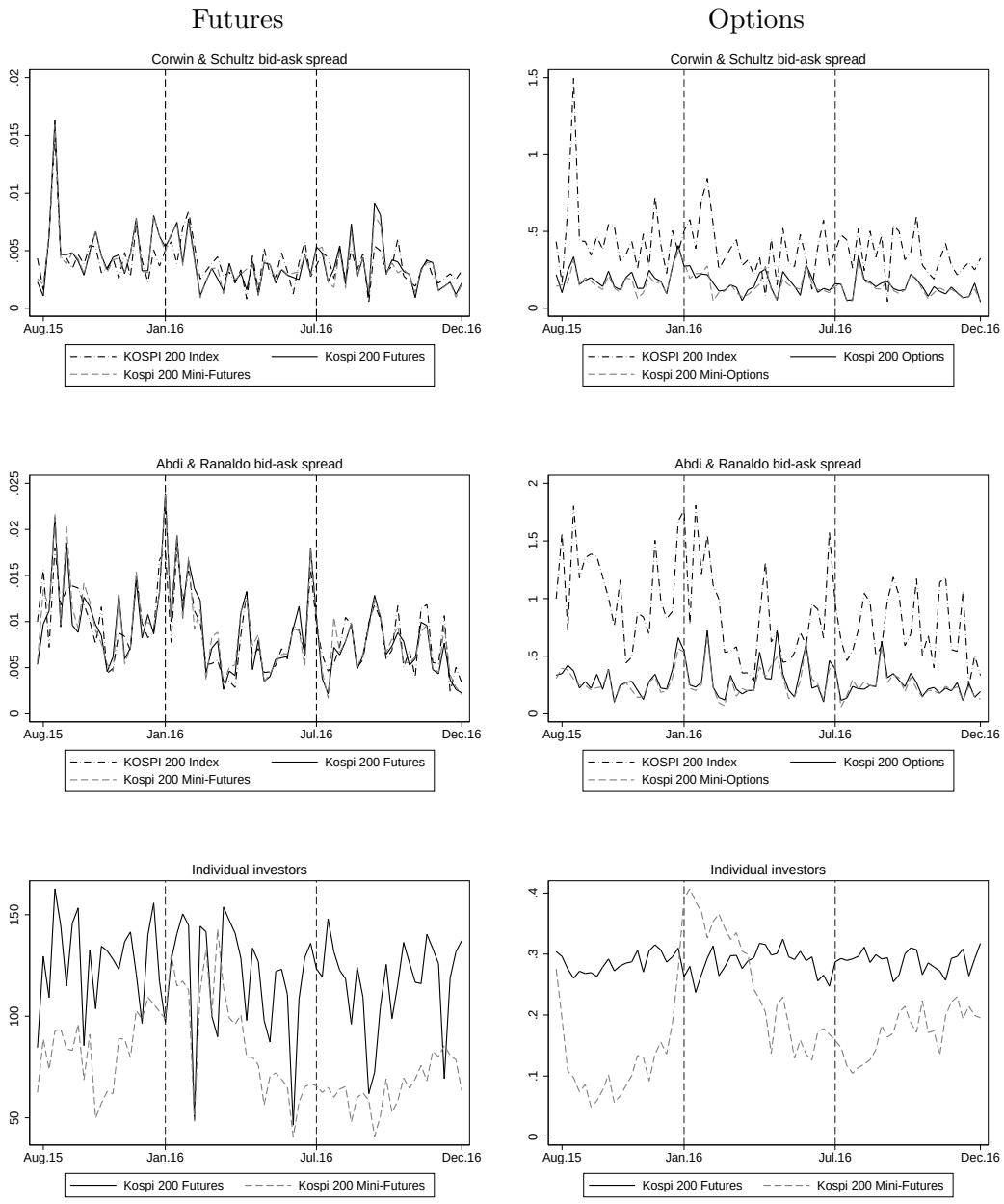


Figure 2.4: Kopsi 200 and Mini KOSPI 200 derivatives: Estimated bid-ask spreads and market share of individuals.

These figures show the weekly evolution of the bid-ask spread and market share of individual investors for Kopsi 200 spot index, Kopsi 200 and Mini KOSPI 200 derivatives between August 01, 2015 and December 31, 2016. The first vertical line corresponds to the introduction of the capital gains tax for the KOSPI 200 derivatives on January 01, 2016 and the second one to its extension to the Mini KOSPI 200 derivatives on July 01, 2016. Bid-ask spreads are estimated with the methods proposed by Corwin and Schultz (2012) and Abdi and Ranaldo (2017).

spread, as measured by the Corwin and Schultz (2012) or Abdi and Ranaldo (2017) methods.
As mentioned previously, only individual traders are subject to CGT, while institutions and foreign traders are exempted. [22] We can therefore obtain evidence on how taxes affect the market share of individuals. To do so, we rely on the daily volume and trading value of individual, institution, and foreign traders provided by KRX and compute the market shares of individuals.
Table 2.3 contains the DiD estimates for the share of the trading value of individual investors. We find that, in line with our expectations, the tax significantly reduces the share of individual traders in all derivatives.
Finally, Table 2.4 reports the result for the impact of the CGT on trading activity (volume, value, and volume-to-open interest ratio), by moneyness and maturity. Since OTM options are more speculative compared to ITM options, we expect a stronger decrease due to the CGT. Our results confirm that this is the case. Results of the Table 2.4 shows that, regardless of the maturity date, there has been a significant decrease in OTM options activity.

2.5 Conclusion

The taxation of financial markets is a very popular topic, as well as a very controversial one. In this paper, we examine the impact of the capital gains tax introduced in 2016 on the Korean derivatives market. This tax reform is somewhat unique in the world and it gives us the special opportunity to shed light on the desirability of such taxes. Our results unambiguously show that the tax reduced the activity in the derivatives market, mainly for individual. However, the tax did not affect the bid-ask spread or the liquidity. The Korean authorities' objective therefore seems to have been achieved: a decline in speculative activity without an effective deterioration of the efficiency of the derivatives market.

22. For the impact of individual investors on volatility, see Foucault et al. (2011).

Table 2.3: Causal impact of the CGT on market quality

This table presents estimates for the coefficients β_{12} from specification, which corresponds to the regression $Y_{i,t} = \alpha + \beta_1 * time_t + \beta_2 * CGT_i + \beta_{12} * time_t * CGT_i + \varepsilon_{i,t}$ where y_{it} denotes one of the 5 market quality variables defined in section 3.3. Period 1 is from August 01, 2015 to June 30, 2016 and period 2 for the study is from January 01, 2016 to December 31, 2016. For period 1 (period 2), $time_t$ is the time dummy variable which take a value of 1 after January 01, 2016 (July 01, 2016), and 0 otherwise. For period 1, CGT_i is a dummy variable which takes a value of 1 if the contract is KOSPI 200 and zero otherwise. $time_t * CGT_i$, is used to test the cross-effect as the product of two dummy variables. The coefficient β_{12} identifies the average impact of the CGT. Column (1) presents the results of the estimated model for KOSPI 200 spot index as a control group whereas column (2) shows the results of the estimations when we consider Mini KOSPI 200 as a control group. For period 2, CGT_i is a dummy variable which takes a value of 1 if the contract is Mini KOSPI 200 and zero otherwise. Column (3) presents the results of the estimated model for KOSPI 200 spot index as a control group whereas column (4) shows the results of the estimations when we consider KOSPI 200 as a control group. T-statistics based on standard errors clustered by group are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Period 1		**Period 2**	
	KOSPI vs spot	**KOSPI vs Mini KOSPI**	**Mini KOSPI vs spot**	**Mini KOSPI vs KOSPI**
$V_{i,t}$				
Futures	-0.293***	-0.656***	0.306***	0.120**
	(-5.64)	(-11.08)	(6.78)	(2.40)
Options	-0.430***	-0.780***	-0.282***	-0.484***
	(-18.22)	(-15.01)	(-6.79)	(-12.28)
$TV_{i,t}$				
Futures	-0.109**	-0.655***	0.110***	0.120**
	(-2.29)	(-11.25)	(2.71)	(2.44)
Options	-0.279***	-0.860***	-0.379***	-0.301***
	(-6.49)	(-20.56)	(-30.61)	(-9.80)
$VOI_{i,t}$				
Futures	-	0.410	-	-1.240***
		(1.41)		(5.25)
Options	-	-0.100**	-	-0.012
		(-2.24)		(-0.51)
$ECS_{i,t}$				
Futures	-0.001	-0.000	0.000	-0.000
	(-0.72)	(-0.10)	(-0.04)	(-0.39)
Options	-0.032	-0.001	-0.024	0.005
	(-1.54)	(-1.42)	(-2.14)	(0.30)
$EAS_{i,t}$				
Futures	0.001	0.001	-0.001	0.000
	(0.48)	(0.29)	(-0.53)	(-0.19)
Options	-0.006	-0.012	0.037	0.005
	(-0.19)	(-0.44)	(-1.53)	(-0.10)
Individuals share				
Futures	-	-2.990***	-	-3.340***
		(-3.47)	-	(-5.64)
Options	-	-13.860***	-	-8.820***
	-	(-12.13)	-	(-8.47)

Table 2.4: Causal impact of the CGT on trading activity by moneyness and maturity

This table presents estimates for the coefficients β_{12} from specification, which corresponds to the regression $Y_{i,t} = \alpha + \beta_1 * time_t + \beta_2 * CGT_i + \beta_{12} * time_t * CGT_i + \varepsilon_{i,t}$ where y_{it} denotes either the logarithm of transaction volume, the logarithm of trading value or the volume to open interest ration for different moneyness and maturity type. $time_t$ is the time dummy variable which take a value of 1 after January 01, 2016, and 0 otherwise. CGT_i is a dummy variable which takes a value of 1 if the contract is KOSPI 200 and zero otherwise. $time_t * CGT_i$, is used to test the cross-effect as the product of two dummy variables. The coefficient β_{12} identifies the average impact of the CGT for each moneyness and maturity type. t-statistics based on robust standard errors are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Period 1			**Period 2**		
Moneyness	**Long**	**Medium**	**Short**	**Long**	**Medium**	**Short**
ATM						
$V_{i,t}$	0.268	-0.994**	-0.976***	-0.210	-0.130	-0.368***
	(0.67)	(-2.31)	(-6.35)	(-0.67)	(-0.34)	(-2.75)
$TV_{i,t}$	0.237	-0.925**	-0.967***	-0.268	-0.089	-0.250***
	(0.55)	(-2.26)	(-10.22)	(-0.85)	(-0.24)	(-2.86)
$VOI_{i,t}$	-0.064	0.029	-0.044	0.023	0.054	1.033
	(-1.50)	(0.19)	(-0.02)	(0.60)	(0.44)	(0.57)
ITM						
$V_{i,t}$	-0.535	-0.365	-0.426	1.019**	0.517	-0.339
	(-1.08)	(-1.02)	(-1.51)	(2.36)	(1.50)	(-1.36)
$TV_{i,t}$	-0.748	-0.447	-0.314	1.777***	0.662*	-0.333
	(-1.04)	(-1.23)	(-1.15)	(4.15)	(1.93)	(-1.40)
$VOI_{i,t}$	-0.222**	0.034	-0.001	-0.144	0.020	-0.056
	(-2.04)	(0.66)	(-0.01)	(-1.26)	(0.47)	(-0.53)
OTM						
$V_{i,t}$	-1.005***	-1.152***	-0.821***	-0.546***	-0.272	-0.647***
	(-4.89)	(-3.57)	(-4.51)	(-3.10)	(-0.95)	(-4.32)
$TV_{i,t}$	-0.775***	-1.260***	-0.907***	-0.086	-0.182	-0.655***
	(-3.14)	(-4.07)	(-2.69)	(-0.44)	(-0.68)	(-2.17)
$VOI_{i,t}$	-0.074***	-0.107	-0.148	0.020	0.059	0.172**
	(-3.83)	(-1.23)	(-1.18)	(1.01)	(0.87)	(2.02)

2.6 Appendix

Table 2.5: Statistical analysis before and after the introduction of the CGT on KOSPI derivatives: Period 1

This table contains the empirical averages of the trading value in million KRW before and after the introduction of the CGT for KOSPI 200 contracts on January 01, 2016. The values are reported for KOSPI and Mini KOSPI 200 futures and options from August, 2015 to June, 2016. The results of t-tests on the equality of means are presented in column (3), (6) and (9) for KOSPI 200 spot index Mini KOSPI 200 and KOSPI 200 contracts respectively. The values in parentheses are the t-statistics. *, **, *** indicate significance at the level of 10%, 5%, and 1%, respectively.

Period 1: August 1, 2015 to June 30, 2016

	Spot index			**Mini KOSPI 200**			**Kopsi 200**		
	Before (1)	**After (2)**	**(3)=(2)-(1)**	**Before (4)**	**After (5)**	**(6)=(5)-(4)**	**Before (7)**	**After (8)**	**(9)=(8)-(7)**
$V_{i,t}$									
Futures	18.10	18.31	0.20***	9.91	10.48	0.56***	11.81	11.72	-0.09**
Options	18.10	18.31	0.20***	10.32	10.87	0.55***	13.64	13.40	-0.23***
$TV_{i,t}$									
Futures	15.00	15.02	0.02	13.10	13.66	0.56***	16.60	16.51	-0.09**
Options	15.00	15.02	0.02	7.64	8.24	0.60***	12.71	12.45	-0.26***
$VOI_{i,t}$									
Futures	-	-	-	3.24	2.77	-0.47	1.10	1.04	-0.06
Options	-	-	-	0.95	0.78	-0.17**	1.68	1.41	-0.27**
$ECS_{i,t}$									
Futures	-0.0046	-0.0037	-0.0008	0.0048	0.0034	-0.001**	0.0048	0.0034	-0.001**
Options	0.004	0.003	-0.00084	0.17	0.15	-0.02	0.19	0.16	-0.032**
$EAS_{i,t}$									
Futures	0.01	0.008	-0.001	0.01	0.009	-0.001	0.010	0.009	-0.001
Options	0.01	0.0088	-0.001	0.27	0.28	0.046	0.302	0.298	-0.007
Individuals share									
Futures	-	-	-	11.35	11.96	0.61***	15.41	15.25	-0.16***
Options	-	-	-	11.88	25.66	13.77***	28.62	28.53	-0.087

Table 2.6: Statistical analysis before and after the introduction of the CGT on KOSPI derivatives: Period 2

This table contains the empirical averages of the trading value in million KRW before and after the CGT for KOSPI 200 contracts on July 01, 2016. The values are reported for KOSPI and Mini KOSPI 200 futures and options from January, 2016 to December, 2016. The results of t-tests on the equality of means are presented in column (3), (6) and (9) for KOSPI 200 spot index Mini KOSPI 200 and KOSPI 200 contracts respectively. The values in parentheses are the t-statistics. *, **, *** indicate significance at the level of 10%, 5%, and 1%, respectively.

Period 2: January 01, 2016 to December 31, 2016

	Spot index			**Mini KOSPI 200**			**Kopsi 200**		
	Before (1)	**After (2)**	**(3)=(2)-(1)**	**Before (4)**	**After (5)**	**(6)=(5)-(4)**	**Before (7)**	**After (8)**	**(9)=(8)-(7)**
$V_{i,t}$									
Futures	18.31	17.95	-0.35***	10.48	10.43	-0.05	11.72	11.54	-0.17***
Options	18.31	17.95	-0.35***	10.83	10.23	-0.63***	13.40	13.25	-0.15***
$TV_{i,t}$									
Futures	15.01	14.91	-0.10***	13.66	13.67	0.01	16.50	16.39	-0.11***
Options	15.01	14.91	-0.10***	8.27	7.76	-0.48***	12.45	12.27	-0.18***
$VOI_{i,t}$									
Futures	-	-	-	2.77	1.24	-1.53***	1.04	0.75	-0.28***
Options	-	-	-	0.07	0.04	-0.30***	1.41	1.11	-0.30***
$ECS_{i,t}$									
Futures	0.0037	0.0034	-0.00034	0.0034	0.0031	-0.00032	0.0034	0.0033	-0.00011
Options	0.0037	0.0034	-0.00034	0.15	0.13	-0.02*	0.16	0.13	-0.03**
$EAS_{i,t}$									
Futures	0.0088	0.0073	-0.0014	0.0093	0.007	-0.0022**	0.0093	0.0068	-0.0024**
Options	0.008	0.007	-0.0014	0.28	0.24	-0.03	0.29	0.25	-0.04*
Individuals share									
Futures	-	-	-	11.96	11.67	-0.29***	15.25	15.08	-0.16***
Options	-	-	-	25.66	14.24	-8.41***	28.53	28.94	0.40

Table 2.7: Statistical analysis before and after the introduction of the CGT on trading activity by moneyness and maturity

This table presents the difference between the empirical averages of the activity based measures (defined in section 2.3.3) before and after the introduction of the introduction of the CGT. t-statistics are given in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Period 1						**Period 2**					
	KOSPI 200			**Mini KOSPI 200**			**KOSPI 200**			**Mini KOSPI 200**		
	Long	**Medium**	**Short**	**Long**	**Medium**	**Short**	**Long**	**Medium**	**Short**	**Long**	**Medium**	**Short**
ATM												
$V_{i,t}$	-0.324	0.193	0.263**	-0.0562	-0.801**	-0.713***	-0.234	-0.338*	-0.0112	-0.0239	-0.209	0.356***
	(-1.63)	(0.90)	(2.50)	(-0.16)	(-2.15)	(-6.35)	(-1.28)	(-1.76)	(-0.12)	(-0.09)	(-0.62)	(3.57)
$TV_{i,t}$	-0.355	0.229	0.297***	-0.117	-0.696*	-0.670***	-0.113	-0.150	0.120**	0.154	-0.0619	0.370***
	(-1.64)	(1.21)	(5.71)	(-0.32)	(-1.92)	(-8.50)	(-0.57)	(-0.89)	(2.39)	(0.66)	(-0.19)	(5.21)
$VOI_{i,t}$	0.00529	0.143	-0.458	-0.0590	0.173	-0.502	-0.0110*	0.0276	2.340	-0.0340	-0.0265	1.307*
	(0.88)	(1.45)	(-0.22)	(-1.39)	(1.53)	(-0.60)	(-1.88)	(0.31)	(1.25)	(-0.90)	(-0.32)	(1.86)
ITM												
$V_{i,t}$	0.726***	0.724***	0.687***	0.191	0.358	0.261	0.555**	-0.173	0.527***	-0.464	-0.690**	0.865***
	(3.29)	(3.72)	(4.68)	(0.40)	(1.19)	(1.08)	(2.10)	(-0.86)	(3.87)	(-1.14)	(-2.47)	(4.09)
$TV_{i,t}$	0.719***	0.768***	0.637***	-0.0288	0.321	0.323	0.700***	0.0832	0.535***	-1.077**	-0.579**	0.868***
	(3.45)	(3.65)	(4.63)	(-0.05)	(1.08)	(1.38)	(2.74)	(0.37)	(3.96)	(-2.67)	(-2.23)	(4.33)
$VOI_{i,t}$	-0.00185	0.0329**	0.0110	-0.224***	0.0665	0.00961	0.00451	-0.0102	0.0644	0.148	-0.0302	0.121
	(-0.59)	(2.07)	(0.13)	(-3.13)	(1.39)	(0.06)	(1.57)	(-0.62)	(1.29)	(1.60)	(-0.77)	(1.17)
OTM												
$V_{i,t}$	0.0671	0.212	0.337***	-0.938***	-0.940***	-0.484***	-0.0609	0.253*	0.376***	0.485***	0.525**	1.023***
	(0.85)	(1.45)	(3.85)	(-4.91)	(-3.28)	(-3.05)	(-0.79)	(1.84)	(4.46)	(3.09)	(2.08)	(8.47)
$TV_{i,t}$	-0.0790	0.333**	0.461**	-0.854***	-0.926***	-0.446*	0.128	0.377***	0.496***	0.214	0.559**	1.152***
	(-0.81)	(2.37)	(2.23)	(-3.79)	(-3.38)	(-1.68)	(1.51)	(2.94)	(2.63)	(1.21)	(2.39)	(4.91)
$VOI_{i,t}$	0.00539	0.118**	0.306***	-0.0689***	0.0113	0.158**	0.00473	0.126***	0.354***	-0.0154	0.0668	0.182***
	(1.57)	(2.30)	(2.81)	(-3.50)	(0.16)	(2.59)	(1.63)	(2.78)	(4.47)	(-0.78)	(1.31)	(4.19)

Major reforms undertaken on KOSPI 200 derivatives

• May 1996: KOSPI 200 futures market opened; Basic deposit = 30 million won

• July 1997: KOSPI 200 option market opened; Decrease in the basic deposit = 10 million won

• November 1997: Increase of the basic deposit = 30 million won

• March 2000: Decrease in the basic deposit = 10 million won

• February 2001: Decrease in the deposit is reduced = 5 million won

• March 2003: Increase in the basic deposit = 15 million won

• Dec. 2006: (500 1,500 for healthy investors; 1,500 3,000 for general investors; 30 million for investors under management)

• May 2011: Base deposit is unified to 15 million won; Abolish purchase account

• July 2012: Upgraded option trading price from 100,000 won to 500,000 won from maturity products if there is no investment experience in November 2014, pre-education and deposit will be applied differently

• July 2015: Mini KOSPI 200 futures and options listing

• January 2016: Transferable income tax imposed on KOSPI 200 futures and options • July 2016: Mini KOSPI 200 futures and options are subject to the tax

Table 2.8: Liquidity measures

Category	**Variable**	**Definition**	Contracts
Activity-based	Volume	$Vi,t = Ln(volume)$ Note that trading volume is divided by 5 if the contract is the Mini KOSPI 200	All contracts
Activity-based	Trading value (Million KRW)	$TVi,t = Ln(trading\,value\,in\,million\,KRW)$	All contracts
Activity-based	Volume-to-open-interest ratio	$V - VOI_{i,t} = V_{i,t}/VOI_{i,t}$ where $VOI_{i,t}$ is the number of open interest for contract i on day t.	All contracts
Transaction cost	Corwin & Schultz (2012)	$ECS_{i,t} = 100 * \frac{2*(exp(\alpha_t)-1)}{(1+exp(\alpha_t))}$ with $\alpha_{i,t} = \frac{\sqrt{2\beta_{i,t}}-\sqrt{\beta_{i,t}}}{3-2\sqrt{2}} - \sqrt{\frac{\beta_{12,i,t}}{3-2\sqrt{2}}}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\beta_{12,i,t} = (maxh_{i,t+1}, h_{i,t} - minl_{i,t+1}, l_{i,t})$ where h_i and l_i are respectively high, and low prices for contract i. Spread is expressed as a percentage.	Nearby contracts for futures Nearby ATM contracts for options
Transaction cost	Abdi & Ranaldo (2017)	$EAR_{i,t} = 100 * (2 * E(c_{i,t} - \eta_{i,t})(c_{i,t} - \eta_{i,t+1}))$ with $\eta_{i,t} = \frac{h_{i,t}-l_{i,t}}{2}$ and $c_{i,t}$ represents the closing price of contract i. Spread is expressed as a percentage.	Nearby contracts for futures Nearby ATM contracts for options

Table 2.9: Main Stock Index Futures Markets in the World, Top 10

	Notional Value (USD trillions)	Volume (million)	Open Interest (million)
CME Group	62	610	3.2
Eurex	22	498	5.6
Japan Exchange Group	11	294	1.6
Hong Kong Exchanges and Clearing	7	83	0.5
ICE Futures US	5	59	1.1
Korea Exchange	*4*	*34*	*0.2*
ICE Futures Europe	3	43	1.0
Euronext	3	44	0.4
TAIFEX	2	61	0.1
China Financial Futures Exchange	1	9	0.1

Source: World Federation of Exchange

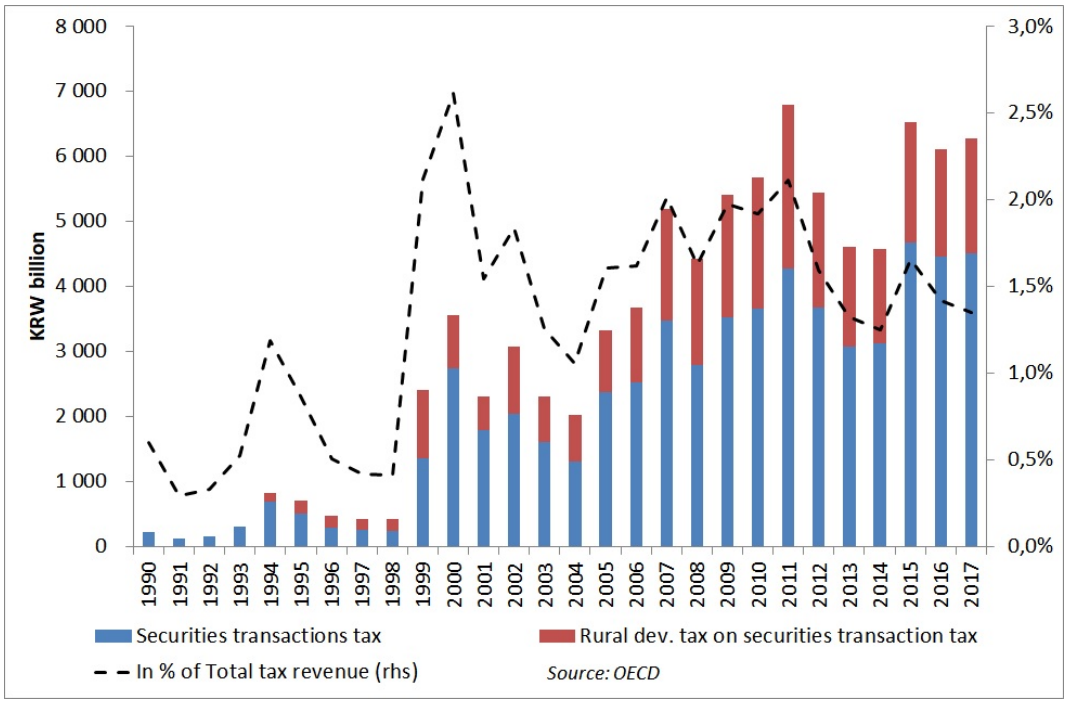


Figure 2.5: Korean STT tax revenue

Chapter 3

Revisiting the impact of the French Securities Transaction Tax

Gunther CAPELLE-BLANCARD and Emna KHEMAKHEM

3.1 Introduction

The taxation of financial transactions has long been the issue of heated debate among economists, and in society at large (Schulmeister, 2009; Matheson, 2011; McCulloch and Pacillo, 2011; Capelle-Blancard, 2014; Gabor, 2016). Since the financial crisis of 2007-2008, there is a strong demand for financial market regulation, and in 2011, the European Commission has launched a proposal for a broad European financial transaction tax (Gabor, 2016). Despite intense discussions, the European Commission's proposal has not been implemented yet, at the time of writing. However, a transaction tax on French stocks has been introduced in France in 2012, prompting a lot of concerns - to say the least. The present study aims to contribute to the debate on the taxation of financial transactions by assessing empirically whether the French Securities Transaction Tax (STT) has impacted trading activity since 2012.

Shortly after its introduction, several academic studies have, independently, examined the impact of the French STT.[1] To identify its impact, all these studies rely on the Difference-in-Difference (DiD) methodology, albeit they use different control groups: French mid- and small-caps (Capelle-Blancard and Havrylchyk, 2016; Becchetti et al., 2014), foreign firms listed on Euronext (Capelle-Blancard and Havrylchyk, 2016; Colliard and Hoffmann, 2017), German firms listed on the Deutsche

1. Table 3.10 in the Appendix provides a summary of the methodology and the main results.

Boerse (Capelle-Blancard and Havrylchyk, 2016; Gomber et al., 2015), or UK firms (Meyer et al., 2015). They also consider different time period: from 20 trading days surrounding the introduction of the French STT (Gomber et al., 2015), to one year (Capelle-Blancard and Havrylchyk, 2016). Moreover, they use either daily data (Capelle-Blancard and Havrylchyk, 2016; Becchetti et al., 2014) or tick-by-tick data (Colliard and Hoffmann, 2017; Gomber et al., 2015; Meyer et al., 2015). Overall, despite these slight differences in methodology, the results all point in the same direction. First, the introduction of the French STT has reduced traded value of securities that are subject to the tax, relatively to non-taxed securities (Colliard and Hoffmann, 2017; Meyer et al., 2015; Capelle-Blancard and Havrylchyk, 2016). The decline was around 30% in the short run (August) and around 20% for the first semester after the introduction of the French STT (while surprisingly not significantly in Gomber et al. (2015)). The STT has also decreased turnover (Capelle-Blancard and Havrylchyk, 2016), the number of trades (Gomber et al., 2015), market depth (Gomber et al., 2015; Colliard and Hoffmann, 2017) and the frequency of quotes (Meyer et al., 2015). Second, all the academic results produced so far on the impact of the French STT suggest that both rational and irrational investors have been driven away, roughly equally. Accordingly, evidence on the bid-ask spread is mixed and very sensitive to the chosen control group: there is a small widening of the spread compared to the German market (Gomber et al., 2015), but there is no significant change compare to foreign firms and small French firms listed on Euronext (Capelle-Blancard and Havrylchyk, 2016; Colliard and Hoffmann, 2017) or compared to UK firms (Meyer et al., 2015). Moreover, there is no significant impact on theoretically based measures of liquidity, such as price impact which captures the ability to trade large quantities quickly, at low cost, and without moving the price (Meyer et al., 2015; Capelle-Blancard and Havrylchyk, 2016). Third, the impact of the STT on volatility is statistically insignificant, notwithstanding how volatility is measured (absolute or squared returns, conditional variance, and high-low range (Capelle-Blancard and Havrylchyk, 2016), realized volatility (Colliard and Hoffmann, 2017), standard deviation of prices (Gomber et al., 2015)). The only exception to these results is a small negative effect on high-low range by Becchetti et al. (2014). Interestingly, Colliard and Hoffmann (2017) analyse the effect of the STT on the activity of various trader types. They find that the STT indirectly affects high frequency traders while they are exempted from the tax and worsens market quality. Further, by analysing the portfolio holdings and portfolio turnover of institutional investors, Colliard and Hoffmann (2017) shows a shift of securities holdings from short-term to long-term investors.

Compared to the previous empirical studies about the impact of the French STT, we do not focus on the introduction of the tax in 2012. Instead, we examine the subsequent impact of the French

STT from 2013 to 2019. Extending the period allows us to get out of the media uproar about the French STT when it was introduced. The design of the French STT allows us to test its effect though the 2012-2019 period. Indeed, the groups of companies that is taxed is adjusted each year according to the evolution of the market capitalization of each firm. The French STT is charged on acquisitions of shares in companies whose registered office is located in France, but only once their market capitalization exceeds one billion euros on December 1 of the previous year. Based on this, the list of shares subject to the tax is updated every year. Hence, we can estimate the impact of the STT for new taxed firms, compared to (almost) similar firms which were already taxed and/or not taxed. At first glance, we might expect a significant decrease in trading activity for new taxed firms, as suggested by previous studies which focus on 2012. However, it is also possible that the decline will be smaller than in 2012, or even insignificant. Even if the information concerning the sample of taxed firm is public, the attention of investors is much less than when the French STT was introduced in 2012 (this intuition is discussed hereafter in the paper; see figure 3.2). Reciprocally, we can assess the impact on market quality for companies that are no longer taxed. Do these companies benefit from not being taxed? Or do investors remain a bit cautious because they have been taxed before?

Econometrically, we rely on two estimation strategy: (i) a standard Difference-in-Difference (DiD) approach implemented each year separately and (ii) a fixed effect panel data model. The results show that the negative impact of the STT on market activity occurred only when the tax was introduced in August 2012. Since then, new taxed firms did not experience a decrease in liquidity, no matter how it is measured, and firms no longer taxed have not benefited from an improvement of liquidity. The tax rate increased in 2017 (from 0.2% to 0.3%) did not have any significant impact either. Overall, contrary to the concerns voiced before its introduction, the STT does not appear to have been harmful to the French stock market.

The remainder of the paper is structured as follows. Section 3.2 describes the data, the empirical strategies and the construction of the liquidity and volatility measures. Section 3.3 reports the empirical results. Section 3.4 concludes.

3.2 Data and methodology

3.2.1 The French securities transaction tax

The financial crisis in 2007-2008 revived discussions on the merits of a Financial Transaction Tax (FTT), particularly in Europe, although the idea of taxing financial transactions dates back to Keynes (1937) and Tobin (1978). In September 2011, the European Commission first called for a coordinated FTT in the European Union. However, not all member states supported this proposal. As a result, eleven countries (Austria, Belgium, France, Germany, Greece, Italy, Portugal, Slovakia, Slovenia, Spain and Estonia) were given the go ahead by the European Parliament and the European Council to proceed with the project. In February 2013, the Commission therefore submitted a proposal for a directive on a harmonised FTT to be implemented in the eleven member states. The negotiation process is still ongoing, but in the meantime and broad France unilaterally introduced STT in August 2012. [2]

In January 2012, the French President Nicolas Sarkozy announced the (re)introduction [3] a 0.1% tax on financial transactions related to French stocks − and denoted French STT in this paper. The terms of the tax have been detailed in the Article 5 of the Supplementary Budget Act for 2012 (Act # 2012-354 of 14 March 2012), published in the Official Gazette *(Journal Officiel)* on March 15, 2012 and completed with the fiscal instruction 3P-3-12 (BOI n61 of 3 August 2012). This instruction has now been repealed and incorporated in the Official Tax and Public Finance Bulletin (BOFiP), principally under BOI-TCA-FIN references, last updated on May 3, 2017. [4] After the election of François Hollande and shortly before its introduction, the tax rate of the French STT was doubled to 0.2%. The tax came into force on August 1, 2012. This STT was amended by the 2017 Budget Act 2016-1917 of December 29, 2016 and the 2018 Budget Act 2017-1837 of December 30, 2017. One of the important changes since 2012 has been the increase in the STT rate by bringing it to 0.3% (GTC Article 235 ter ZD, V of the Finance Act for 2017). The new tax rate applies to acquisitions made on or after January 1, 2017.

The French STT is payable when five conditions are met cumulatively. There must be (i) an acquisition for consideration (ii) resulting in a transfer of ownership (iii) of shares or equivalent

2. Since then, Italy has done the same in 2013 (Capelle-Blancard, 2017).

3. Until 2008, stock market transactions were taxed in France by application of the so-called *"Impôt de bourse"* (Capelle-Blancard, 2016)

4. Actually, the French STT has three components: a tax on acquisitions of French and similar instruments (Article 235 ter ZD), a tax on orders cancelled in the context high frequency trading (Article 235 ter ZD bis) and a tax on naked sovereign credit default swaps (Article 235 ter ZD ter). Only the first part is effectively in force.

securities (iv) admitted to a regulated market and (v) issued by a French company with a market capitalization of more than €1 billion. To prevent tax avoidance, the French STT applies to securities admitted to a regulated market, but whatever the venue of the transaction (e.g. over-the-counter or via a multilateral trading facility). The tax is due by all investors, regardless of their country of residence and regardless of the place of conclusion of the contract. Moreover, the condition of transfer of ownership requires an inscription of the acquired securities in the buyer's securities account. In general, securities are settled and delivered on Day+2 when the acquisition is made on a platform established in France. This implies that purchases and sales of the same security on the same trading date generate a zero net balance. Accordingly, intraday trading is exempted. [5]

For our identification strategy, two specific features of the tax are important. First, the STT must be paid on the acquisition of stocks issued by companies whose headquarters are located in France. Second, firms are subject to the STT only if their market values is above €1 billion on December 1 of the previous year.

3.2.2 The sample

To assess the impact of the French STT over the period 2012-2019, we first have to list the companies subjected to the tax. This list varies over the period, since the tax applies only to companies with a market capitalization of at least €1 billion on December 1 the previous year.

Table 3.1 (Panel A) lists the number of taxed and non-taxed companies for each year. There were 109, 114, 128, 134, 136, 140, 142 and 132 taxed firms in 2012, 2013, 2014, 2015, 2016, 2017, 2018 and 2019, respectively. In our empirical analysis, our firm sample is drawn from the Euronext 100 index (Panel B) and the Next 150 (Panel C). However, not all the firms subject to the French STT belong to theses indices (Panel D). This may be due to several factors like their free float is too

5. The condition about the transfer of ownership has been highly debated since the French STT was introduced. Indeed, the French Constitutional Court has validated the abolition of the condition of transfer of ownership in order to include intraday transactions in the scope of the tax as from January 1, 2017. The legislator postponed this application to January 1, 2018 for two reasons: (i) to avoid giving a negative message to the financial sector in the context of the Brexit, (ii) to be consistent with the French position with regard to the discussions initiated at the European level on the European STT. Finally, during the Paris Europlace 2017 Days, the Prime Minister announced the repeal of the extension of the STT to intra-day transactions as of January 1, 2018. This decision was justified by the fact that such a provision is inapplicable and by the fact that it would penalize the Paris financial center as well as the coherence of the tax policy. The extension of the STT to intraday transactions was therefore repealed by the Finance Act for 2018 in Article 39, which cancels Article 62 of the Finance Act for 2017.

low (e.g. CIC or Autoroute Paris-Rhin-Rhone, with a free float lower than 3%) or because the company is controlled by a block of shareholders (e.g. Areva is held at 83% by the Commissariat à l'Energie Atomique and the French Government, Euler Hermes is held at 67% by the founding family and at 18% by LVMH).

We construct our initial sample of stocks as follows. First, we collect all the firms that were taxed through the 2012-2019 period. Second, we collect all of the constituents of the Euronext 100 and Euronext Next 150 indexes, which represent the 250 most liquid stocks listed on Euronext. Among those 250 stocks, we keep only French firms each year. Third, we expanded our database of the two indexes by identifying the companies taxed but not present in the indexes. Finally, for each stock, we collected daily opening and closing prices, trading volume, trading value, bid, ask, high and low prices from May 1, 2012 to March 29, 2019. Thus, our panel is initially composed of a maximum of 1,803 days $*$ 252 firms=454,356 observations. However, we drop from the initial sample five firms. For three of them, they are not listed on Euronext Paris. There is also one firm that have experienced a takeover bid in 2012 (CFAO) and another one for which the market capitalization exceeds €1 billion, but with its headquarter in Luxembourg (Eurofins Scientific). This leaves 445,588 observations, i.e. 98% of the initial sample.

In order to define our control and treated groups every year N, N= 2012, ..., 2019, we defined 4 samples of firms as follows:

— *NewSTT* : New taxed firms, i.e. firms taxed in N but not in $N-1$. [6]

— *NoLongerSTT* : No longer taxed firms, i.e. firms taxed in $N-1$ but no more taxed in N.

— *STT* : Already taxed firms, i.e. firms taxed in N and $N-1$.

— *NoSTT* : Non-taxed firms, i.e. firms neither taxed in N nor in $N-1$.

Note that sample change every year. In the following subsection, we detailed how we define our treated and control groups based on this four samples. Table 3.2 (Panel A) gives details of the number of firms in each category from our initial sample.

To avoid liquidity bias, we exclude companies for which total volume was lower than k€60,000. Also, in order to ensure the hypothesis of homogeneity between treated and control groups required in DiD methodology, we exclude (non-taxed) firms with market capitalization lower than €0.5 billion and (taxed) firms that have a market capitalization above €3 billion. This selection allows us to get

6. In 2012, N is August an $N-1$ is July 2012

Table 3.1: Number of taxed and non-taxed companies

Panel A lists the total number of French firms subject to the tax (FR, STT). Panel B lists the number of French large caps subject to the tax (FR, STT) and non-French large caps not subject to the tax (No FR, no STT) that compose the Euronext 100 index. Panel C lists the number of French large caps subject to the tax (FR, STT), French mid and small caps (FR, no STT) and non-French firms (No FR, no STT) not subject to the tax that compose the Next 150 index. Panel D lists the number of French taxed firms not included in the Euronext 100 nor in the Next 150 indexes (FR, STT).

	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Panel A: Firms subject to the French STT								
FR, STT (1) = (2) + (5) + (8)	109	114	128	134	136	140	142	132
Panel B: Euronext 100 index								
FR, STT (2)	61	58	61	62	61	62	63	63
FR, no STT (3)	1	1	1	1	1	2	2	1
No FR, no STT (4)	38	41	38	37	38	36	35	36
Panel C: Next 150 index								
FR, STT (5)	32	34	31	33	38	34	35	32
FR, no STT (6)	43	45	47	44	41	44	35	37
No FR, no STT (7)	75	71	72	73	71	72	80	81
Panel D: Not included in the Euronext 100 and Next 150 indexes								
FR, STT (8)	16	22	36	39	37	44	44	37

unbiased sample and to use groups with comparable market capitalization. Therefore, we consider an unbalanced panel of 125 French firms (98,372 observations). Figure 3.1 graphs the changes in the tax rate across these firms over the period 2012-2019. This graph allows us to differentiate between firms that have been taxed since the beginning in 2012, those which have never been taxed and those that have experienced round-trips. Table 3.2 (Panel B) details the number of firms and the average market capitalization of the selected firms. It confirms that the treated sample *NewSTT* is close to the control sample *NoSTT* and that the treated sample *NoLongerSTT* is close to the control sample *STT*.

To complement the control groups described above, we have also included a control group of foreign companies listed on the Euronext 100 and the 150 in order to assess the impact of the increase in the tax rate in 2017.

Figure 3.1: Changes in the tax rate across firms: 2012-2019

Table 3.2: Number and average market capitalization for the different categories of firms

Panel A of this table provides the number of firms for each categories (detailed in section 3.2.2) in the initial sample. The initial sample includes all French stocks included in the Euronext 100 and the Next 150 indexes, as well as taxed stocks not included in the indexes. Panel B provides the number of firms and the average market capitalization of the selected firms. The selected sample excludes all companies that meet at least one of the following criteria: total volume over one year period below k€60,000, firms with market capitalization less than €0.5 billion and already taxed firms with market capitalisation above €3 billion.

Panel A : All sample (only French firms)								
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
# of firms								
NewSTT	109	7	14	11	10	6	14	3
NoLongerSTT	0	0	0	1	6	1	2	5
NoSTT	43	45	47	43	35	43	33	32
STT	0	107	114	123	126	134	128	128
# taxed	109	114	128	134	136	140	142	131
# non taxed	43	45	47	44	41	44	35	37
Panel B: Selected sample (Total trading value ¿ k€60,000; market cap. between €0.5 - €3.0 billion)								
# of firms								
NewSTT	97	5	9	8	8	5	10	3
NoLongerSTT	0	0	0	1	6	1	2	4
NoSTT	12	9	7	8	15	9	17	10
STT	0	29	25	30	24	31	26	28
Avg. Market Capitalization								
NewSTT	10,282	1,286	1,496	1,690	2,206	1,396	1,957	1,283
NoLongerSTT	_	_	_	936	826	898	912	862
NoSTT	689	668	659	707	678	698	690	732
STT	_	1,835	2,042	1,835	1,954	1,852	2,034	1,848

3.2.3 Empirical strategy

Our empirical strategy to identify the causal impact of the French STT relies on Difference-in-Difference (DiD) (Card and Krueger, 2000; Bertrand et al., 2004; Abadie, 2005). The specific attributes of the French STT allows us to consider four quasi-experiments. We consider four different treatments:

— First, the introduction of French STT with a tax rate of 0.2% in 2012;
— Second, the inclusion of firms in the group eligible for the French STT from 2013 to 2019;
— Third, the removal of firms from the group eligible for the French STT from 2013 to 2019;
— Fourth, the increase in the French STT rate from 0.2% to 0.3% in 2017.

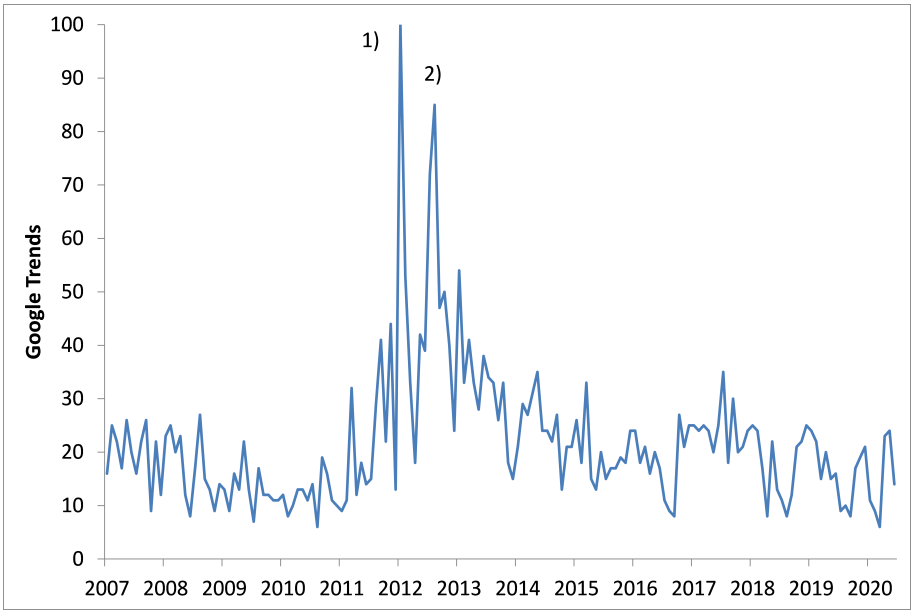
The choice of the control and treated groups depends on these treatments. In the first quasi-experiment (*Introduction*), the treated group is $NewSTT$ and the control group is $NoSTT$; the test is performed once, over a period of six months straddling August 1, 2012. In the second quasi-experiment (*Inclusion*), the treated group is $NewSTT$ and there are two possible control groups: STT and/or $NoSTT$; the test is performed successively seven times between 2013 and 2019, over a period of six months straddling January 1 each year. In the third quasi-experiment (*Removal*), the treated group is $NoLongerSTT$ and the control groups are the same as before: STT and/or $NoSTT$; the test is also performed successively seven times between 2013 and 2019, over a period of six months straddling January 1 each year. In the fourth quasi-experiment (*Increase*), the treated group is STT and the control group is $NoSTT$; in addition, to increase the size of our sample, we consider foreign firms including in the Euronext 100 and Next 150 indexes, no FR. The test is performed once over a period of six months straddling January 1, 2017.

Overall, our intuition is that the impact of the French STT was time-limited. In 2012, at the time it was introduced, the French STT has fuelled very lively debates. The concerns expressed at that time may have exacerbated the stock market's reaction. However, after a few months, the first results have concluded to a small decrease in market activity. We may assume that the adjustments made subsequently have had little impact. To illustrate our hunch, Figure 3.2 shows how awareness of the STT in France has evolved from 2007 to 2020. Our proxy for awareness is the web search volume in France with the keyword *"taxe sur les transactions financières"* provided by Google Trends. After peaking in 2012, the level of public attention has stabilized (Panel A). In particular, there is no particular concern in 2017 when the tax rate has increased from 0.2% to 0.3%. There is also no special attention around January each year, when the group of taxed companies is redefined (Panel B).

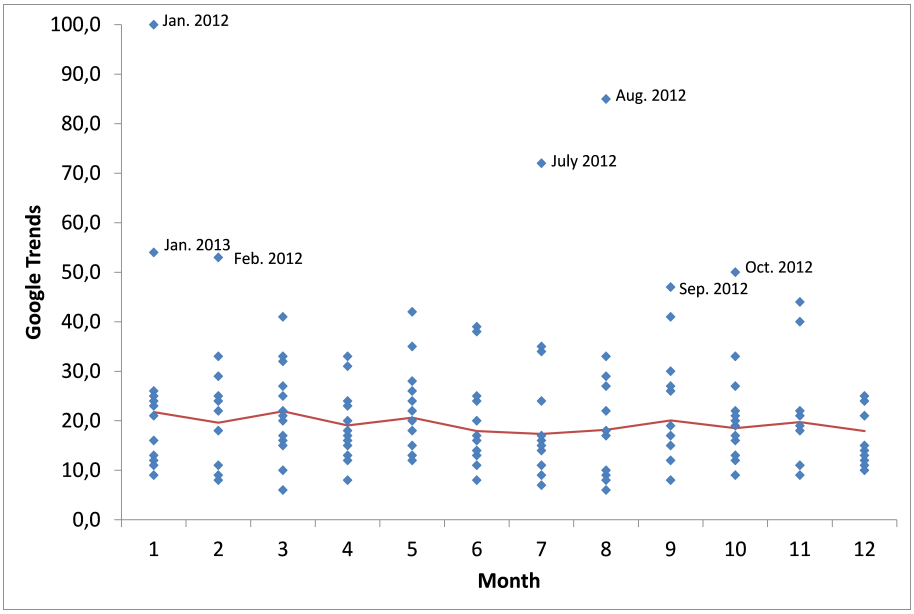
Figure 3.2: STT awareness in France from 2007 to 2020

This figure uses Google Trends to capture public attention towards STT in France. The query is limited to France, with the keyword *"taxe sur les transactions financières"*. The search volume is normalized at 100. In Panel A, we present the query's search volume over time: 1) and 2) corresponds to the date of announcement of the French STT (January 2012) and to the date of implementation (August 2012), respectively. In Panel B, we report the search each month (January = 1, ... December = 12); the red line is the average over the period.

Panel A



Panel B



3.2.4 Econometric models

This section presents the methodology used in our empirical analysis. For the quasi-experiments *Introduction* and *Increase*, the impact of the French STT is estimated once, but for *Inclusion* and *Removal* the impact of the French STT is estimated on a yearly basis over on the 2013-2019 period; we consider Difference-in-Difference and Panel data estimation depending on whether the impact is estimated for a given year or for the whole period.

To identify the impact of the STT on a yearly basis, we rely on the Difference-in-Difference (DiD) methodology, and, hence we estimate the following econometric model:

$$V_{it} = \alpha + \gamma D_i + \lambda D_t + \beta STT_{it} + \varepsilon_{it} \quad (1)$$

where V_{it} is a measure of market liquidity or volatility for the firm i at time t, $D_i = \{0, 1\}$ is a group dummy variable with group 1 is the treated group and group 0 is the control group and $D_t = \{0, 1\}$ is a time dummy variable which takes the value of 1 after the tax was charged and 0 otherwise, STT_{it} is a dummy variable that is equal to 1 for French firms subject to the STT (market values of more than €1 billion) and 0 otherwise; and ε_{it} is an error term. Our coefficient of interest is β which assess either (i) the impact of becoming taxed or (ii) the impact of no longer being taxed. We estimate the equation with firm-level clustering of the errors that is allowing for correlation of the error term over time within firms (Bertrand et al., 2004).

To identify the impact of the STT through the entire period, we used a more general approach (Besley and Burgess, 2004; Imbens and Wooldridge, 2009). The standard DiD model setup supposes two time periods and two groups: in the first period no one is treated, and in the second period some individuals are treated (the treated group), and some individuals are not (the control group). Since we have more than two time periods and changes in treatment groups, we deviate from the standard DiD setup. Our econometric analysis is therefore based on panel data regressions of the form :

$$V_{it} = \alpha + \gamma_i + \lambda_t + \delta_{it} + \beta STT_{it} + \varepsilon_{it} \quad (2)$$

where V_{it} is a measure of market liquidity or volatility for the firm i at time t, STT_{it} is a dummy variable that takes into account changes in the tax (which is a treatment indicator equal to 1 if firm

i in day t is subject to the treatment and 0 otherwise), γ_i is a firm fixed effect, λ_t is a daily fixed effect which takes into account trend effects common to all firms, δ_{it} a firm-specific trend coefficient which multiplies the time fixed effect by the firm's fixed effect and which allows the treated and controlled firms to follow different trends in a limited but potentially revealing manner. [7] Finally, ε_{it} is an error term. We estimate the equation allowing clustered standard errors by firms to deal with serial correlation problems (Bertrand et al., 2004).

3.2.5 Measuring market liquidity and volatility

In this section, we detail the variables we construct to test the effect of the tax on the liquidity and volatility of the French equity market. Table 3.3 reports some descriptive statistics.

Based on the previous literature, we identify five main aspects of market liquidity: Tightness (the cost of trading); Depth (the capacity to trade without causing price movements); Resiliency (the speed at which the marginal price impact increases as trading quantities increase); Breadth (the overall size of the volume traded); Immediacy (the cost to be applied when selling/buying quickly). Following Sarr and Lybek (2002), we classify liquidity measures into three main categories, ranging from the least sophisticated to the most sophisticated: activity-based measures (trading volume, trading value), transaction-cost measures (bid-ask spread, Corwin-Schultz spread), and price-impact measures (liquidity ratio). These measures reflect complementary aspects of market liquidity.

Trading volume $V_{i,t}$ is defined as the logarithm (ln) of all contracts traded on day t. The trading value $TV_{i,t}$ is the logarithm of the market value of contract i during a trading day t. Trading value and Volume capture market breadth and depth. Another widely-used measure of liquidity is the bid-ask spread, which assesses tightness. We compute relative spread $Spread_{i,t}$ as the difference between the ask price and the bid price divided by the mid price. We also use the method of Corwin and Schultz (2012) to estimate bid-ask spread using observed daily high and low prices.

7. Overall, the estimation of the panel model with firm-specific trends is likely to be more robust and convincing when pre-treatment data show a clear trend that can be extrapolated to the post-treatment period (Besley and Burgess, 2004).

Estimated Corwin-Schultz Spread of firm i in day t is given as: $ECS_{i,t} = 100 * \frac{2*(exp(\alpha_t)-1)}{(1+exp(\alpha_t))}$ with $\alpha_{i,t} = \frac{\sqrt{2\beta_{i,t}}-\sqrt{\beta_{i,t}}}{3-2\sqrt{2}} - \sqrt{\frac{\gamma_{i,t}}{3-2\sqrt{2}}}$, $\beta_{i,t} = 1/2[(h_{i,t+1}-l_{i,t+1})^2+(h_{i,t}-l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t})-min(l_{i,t+1}, l_{i,t}))$ where h_i and l_i are respectively high, and low prices for firm i. $Spread_{i,t}$ and $ECS_{i,t}$ are expressed in percentage.

The market's response to substantial buying or selling pressure is an important aspect of illiquidity. Liquidity denotes the ability to trade large quantities quickly, at low cost, and without moving the price. A number of indicators of market resiliency reflect this definition. Amihud (2002) proposes a measure of illiquidity, which is the daily ratio of absolute return to its € volume, and argues that it serves as a rough measure of price impact : $Illiq_{i,t} = \frac{|R_{i,t}|}{Value_{i,t}}$ where $R_{i,t} = ln(P_{i,t}/P_{i,t-1})$ and $P_{i,t}$ is the closing price of firm i in day t. This measure can be interpreted as the daily price response associated with one euro of trading value.

As a measure of volatility, we consider high-low range $HLR_{i,t}$ defined as the squared log difference between high and low prices of firm i in day t divided by 4*log(2). Parkinson (1980) shows that the daily high-low range is an unbiased estimator of daily volatility more efficient than the squared daily return. More recently, Brandt and Diebold (2006) find that its efficiency is comparable with that of the realized variance computed as the sum of squared 3-hour returns, while it is more robust against the effects of market microstructure noise, particularly bid-ask bounce. [8]

3.2.6 Preliminary analysis

Before moving on to the econometric analysis, we can get a first idea of the impact of the French STT by looking at the average values, before and after the firms have been taxed, for each period. Table 3.4 reports such summary statistics for our proxies for market liquidity and volatility (defined in section 3.2.5). The table shows the average value for the two treated groups *newSTT* and *NoLongerSTT* and the control groups *STT* and *noSTT*, pooled together for readability. Then, we test whether the Difference-in-Difference are statistically significant. When we look at our statistics,

8. Table 3.11 in the Appendix provides pairwise correlation coefficients for the measures of liquidity and volatility. Unsurprisingly, all coefficients are significantly different from zero (except between daily turnover and liquidity ratio). However, they are sufficiently low (except between trading volume and trading value) to justify the use of a wide range of measures.

we notice that the groups generally move in the same direction (increase or decrease) with little or no significant differences between them, except for the introduction of the French STT in 2012, as reported in previous studies, and 2013 but with a positive impact. Overall, it's a first hint in favor of our hunch that the French STT did not have an effect on the stock market on the long run. We will check this finding in more detail in the next section.

Table 3.3: Descriptive statistics of the selected sample

This table provides descriptive statistics of the French stocks included in the Euronext 100 and Next 150 indexes, as well as taxed firms not included in the indexes (excluding 5 firms that have experienced a takeover bid or not listed on Euronext Paris). We exclude companies for which total volume was lower than K€60,000 and firms with market capitalization lower than €0.5 billion and above €3 billion. The sample period extends from May 2012 to March 2019 (1,803 trading days). All the data are daily. $Close_{it}$ is the closing price for the stock i on the day t. $Spread_{i,t} = 2 * 100 * (Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$, where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100 * (2 * (exp(\alpha_t) - 1))/((1 + exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3 - 2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3 - 2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4 * ln(2))$ is a proxy of volatility. $Volume_{it}$ and $Value_{it}$ are the trading volume in thousands and the trading value and thousand € respectively. $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value and thousand € respectively. MV_{it} is the market value of the stock i on the day t in million €. $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t. Illiquidity ratio is expressed in € million of trades for a price change of 1%.

Variable	Obs.	Mean	Std. Dev.	Min	Max
$Close_{it}$(€)	98,372	41.59	47.48	0.45	570.00
$Spread_{i,t}$ (%)	94,819	0.40	0.51	-5.71	46.57
$ECS_{i,t}$ (%)	56,084	0.97	0.82	0.00	13.92
$HLR_{i,t}$	94,863	0.02	0.04	0.00	4.04
$Volume_{it}$ (thousand)	94,863	383	2,552	0	193,086
$Value_{it}$ (thousand €)	94,863	3,504	8,683	0	579,872
$V_{i,t}$ (thousand. log)	94,731	10.70	1.92	4.61	19.08
$TV_{i,t}$ (thousand €. log)	94,811	14.01	1.50	4.61	20.18
MV_{it} (million €)	97,936	1,549	875	209	9,384
$Return_{it}$ (%)	98,372	0.00	0.02	-1.20	0.35
$Illiq_{i,t}$ (million €)	94,811	0.02	0.19	0.00	27.92

Table 3.4: Average value pre- and post-tax

This table reports the pre-tax and post-tax average for our proxies of liquidity and volatility. These statistics are calculated using the selected sample for the treated and control groups every year (from May to October for 2012 and from October $N-1$ to March N; N=2013, ..., 2019). DiD is the difference between the average variation of the treated group $(post-pre)_{treated}$ and the average variation of the control group $(post-pre)_{control}$.$V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value in thousand € respectively. $Spread_{i,t} = 2*100*(Ask_{i,t}-Bid_{i,t})/(Ask_{i,t}+Bid_{i,t})$ where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100*(2*(exp(\alpha_t)-1))/((1+exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}}-\sqrt{\beta_{i,t}})/(3-2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3-2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1}-l_{i,t+1})^2+(h_{i,t}-l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1},h_{i,t})-min(l_{i,t+1},l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t where $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. Illiquidity ratio is expressed in € million of trades for a price change of 1%. High-low range, $HLR_{i,t} = (ln(h_{it})-ln(l_{it}))/(4*ln(2))$ is a proxy of volatility.

Year		$V_{i,t}$		$TV_{i,t}$		$Spread_{i,t}$		$ECS_{i,t}$		$Illiq_{i,t}$		$HLR_{i,t}$	
	Period	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
2012	Control	10,360	10,230	12,780	12,660	0,688	0,609	1,289	1,009	0,095	0,077	0,024	0,016
	Treated	12,550	12,200	15,770	15,510	0,422	0,443	1,170	0,916	0,129	0,100	0,018	0,011
	DiD	-0.227***		-0.141**		0.100*		0.025		-0.011		0.001	
2013	Control	11,32	11,58	14,25	14,64	0,319	0,296	0,931	0,926	0,014	0,009	0,0140	0,0133
	Treated	10,86	11,45	13,71	14,48	0,274	0,251	0,707	1,018	0,0124	0,00843	0,00703	0,0139
	DiD	0.321***		0.388***		-0.001		0.316***		0.001		0.008***	
2014	Control	11,11	11,20	14,40	14,56	0,276	0,261	0,747	0,840	0,008	0,00857	0,00860	0,0106
	Treated	11,26	11,34	13,95	14,12	0,453	0,411	1,025	1,007	0,0173	0,0182	0,0142	0,0192
	DiD	-0.020		0.008		-0.028		-0.111		0.001		0.003	
2015	Control	10,98	11,25	14,28	14,67	0,354	0,324	1,132	1,066	0,0205	0,0104	0,0211	0,0195
	Treated	10,47	10,77	13,87	14,27	0,483	0,391	0,996	1,012	0,0197	0,0104	0,0145	0,0145
	DiD	0.034		0.003		-0.061		0.082		0.001		0.002	
2016	Control	10,38	10,65	13,92	14,09	0,390	0,431	0,947	1,238	0,0273	0,0262	0,0154	0,0288
	Treated	10,91	11,12	14,17	14,21	0,395	0,518	1,311	1,698	0,0147	0,0173	0,0267	0,0477
	DiD	-0.054		-0.131		0.082		0.096		0.004		0.008	
2017	Control	10,76	10,97	14,03	14,13	0,402	0,454	1,052	1,440	0,0273	0,0294	0,0176	0,0334
	Treated	10,68	11,20	13,86	14,24	0,362	0,473	1,243	1,616	0,0156	0,0144	0,0293	0,0445
	DiD	0.126		0.035		0.095***		-0.038		0.002		-0.002	
2018	Control	10,84	10,98	14,15	14,31	0,330	0,345	0,858	1,081	0,0124	0,0139	0,0115	0,0172
	Treated	10,50	10,64	13,85	13,98	0,377	0,360	0,991	1,105	0,0172	0,0174	0,0168	0,0172
	DiD	-0.010		-0.025		-0.033		-0.109		-0.001		-0.005**	
2019	Control	11,35	11,28	14,53	14,43	0,300	0,297	1,444	1,220	0,0129	0,0112	0,0315	0,0225
	Treated	11,01	10,77	14,28	13,99	0,431	0,424	1,482	1,345	0,0196	0,0203	0,0420	0,0252
	DiD	-0.168		-0.189		-0.004		0.087		0.002		-0.008	

*, **, *** indicate significance at the level of 10%, 5%, and 1%, respectively.

3.3 Empirical results

3.3.1 The parallel trends assumption

DiD model is based on the assumption of parallel trends which assumes that non-treated firms provide the appropriate counterfactual trend that treated groups would have followed in the absence of treatment. In order to assess the validity of this assumption we rely on Figure 3.3 which plots the quarterly un-weighted average of market liquidity and volatility measures for taxed and non-taxed firms. This graphs show that market liquidity and volatility exhibit overall parallel trends. [9]

3.3.2 DiD results

We first investigate the impact of the French STT each year separately from 2012 to 2019.

Yearly impact of being new taxed

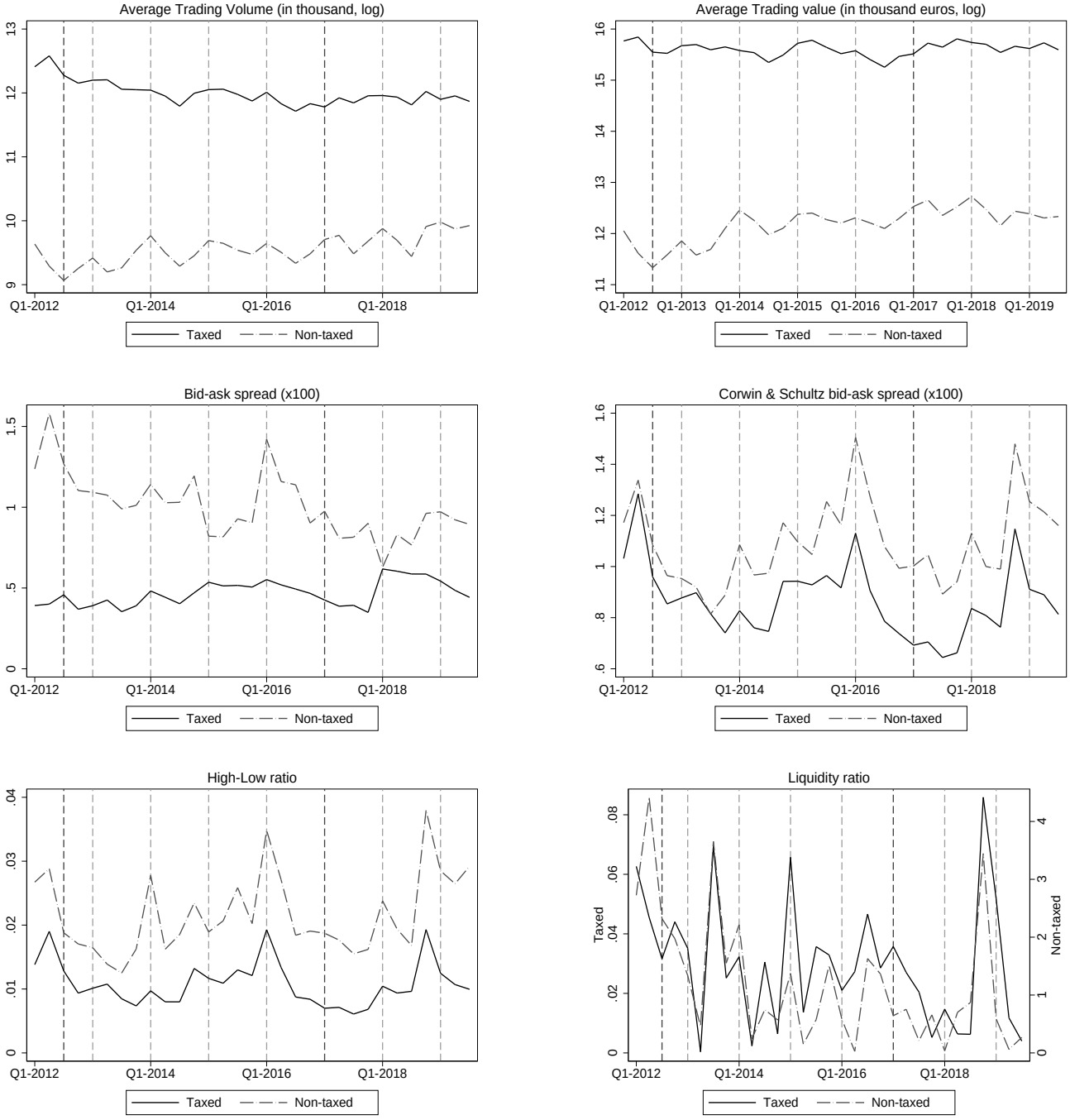
The results of the impact of the French STT between 2012 and 2019 are summarized in Table 3.5. In this table, we rely on the standard DiD model with different groups of control: STT is composed with firms that are already taxed at least for two consecutive year, whereas $NoSTT$ is composed by firms that have not been taxed at least through the two-periods. In column (1) we capture if the treated group ($NewSTT$) is going far from the second control group ($NoSTT$), while in column (2) we assess if the treated group ($NewSTT$) is getting closer to the first control group (STT). A negative coefficient indicates a decrease while a positive coefficient indicates an increase in liquidity or volatility measures following the introduction of the tax.

In 2012, the introduction of the STT has both reduced trading volume and value of firms subject to the STT relatively to the control group. We observe a decrease of 22% and 14% in trading volume and value, respectively. This result is of the same order of magnitude as that found in previous studies. The other variables are not significant except for the bid-ask spread that records an increase, but only significant at 10% level. Overall, finding that the introduction of the STT results in a decline of trading activity is not surprising. The crucial question is whether the tax discouraged

9. The correlation coefficients between taxed and non-taxed groups confirm this finding. Table 3.12 in the Appendix shows that correlations can range from 27% to 63% depending on the measure in question.

Figure 3.3: Dynamics of the stock market activity and volatility for the taxed and non-taxed groups

These figures present quarterly un-weighted average for taxed and non-taxed firms. The vertical dash dark lines in 2012 and 2017 indicate the date of the introduction of the French STT and the date of the update of the tax rate respectively. The vertical dash light lines indicate the dates on which the lists of companies subject to tax were updated.



"rational" or "noise" traders and, thus, its impact on execution costs and market resiliency. As discussed in Section 3.2.5, measures of trading activity are imperfect measures of liquidity. When considering Corwin-Schultz spread or liquidity ratio, there is no robust evidence that the STT has had a statistically highly significant impact. We can conclude that the introduction of the STT has not affected market liquidity, insofar as the market ability to trade large quantities without moving the price has not changed. If we turn to the effect of the STT on market volatility as measured by the high-low range, results show no evidence of an impact of the introduction of the STT. Therefore, our results reject the hypothesis that the introduction of the STT increases market volatility due to the decrease in trading volumes. At the same time, the alternative hypothesis that the STT mainly drives away noise traders and reduces volatility is not supported by our data. Most likely, both effects are at work and the introduction of the STT has driven out both "rational" and "noisy" traders, the two effects cancelling each other out. Our results are in line with recent econometric results which assess the impact of the introduction of the STT on French market (see Capelle-Blancard and Havrylchyk (2016); Colliard and Hoffmann (2017); Meyer et al. (2015)).

From 2013 onwards, our new taxed companies are compared to two groups of companies: (1) those that are not taxed and (2) those that have already been taxed in the previous period. The results show overall no impact of the STT for all the variables. Indeed, the effect of the STT tends to vanish after 2012 for all variables. Indeed, regardless of the proxy, regardless of the control sample, and regardless of the year from 2013 to 2019, most of our coefficient are not significant. Of course, there are some exceptions, but these are difficult to interpret, especially since they suggest either a positive or and negative impact. By performing many statistical tests, we are facing the risk that some results appear to be statistically significant at the usual thresholds, but not economically relevant. Our results only make sense if we look at the whole picture with, admittedly, a certain degree of discretion. If we consider a 10% level threshold, from 2013, out of our 84 estimates (6 variables * 7 years * 2 control groups), 71 are not significant, 8 suggest a negative impact (either a decrease in liquidity, an increase of the spread or the volatility) and 5 an improvement.

Overall, we can conclude that the market adapts to the introduction of STT after only one year. This suggest that financial market players are not affected and therefore make this policy almost painless after only one year.

Yearly impact of being no more taxed

In this section, we discuss the results for firms that are no more taxed. Indeed, the design of the French STT allows us to have groups of companies that have been taxed, but from one year to the next may are no longer taxed. These groups are only available between 2015 and 2019, which reduces our study period. The causal effect of no longer being tax between 2015 and 2019 are summarized in Table 3.6. As the previous sub-section, DiD model is etimated for two different groups of control: STT is composed with firms that are already taxed at least for two consecutive year, whereas $NoSTT$ is composed by firms that have not been taxed over the period. Therefore, in column (1) we capture if the treated group ($NoLongerSTT$) is getting closer from the second control group ($NoSTT$), while in column (2) we assess if the treated group ($NoLongerSTT$) is going far from the first control group (STT).

For Table 3.6, regardless of the year, the results show there is no impact of no longer being taxed on market quality. Indeed, neither the liquidity nor the volatility of no longer taxed firms appears to be reacting. In other words, liquidity and volatility measures of companies that are no longer taxed are not found to be closer to those of companies that have never been taxed. Moreover, there is no evidence that no longer taxed companies are going far from companies which continues to be taxed. One possible explanation is that investors adopt a precautionary attitude towards those firms and not necessarily adjust to changes in the company's tax situation. [10]

Impact of an increase of tax rate

As noted before, one of the important changes since 2012 has been the change in the STT rate by bringing it from 0.2% to 0.3% from January 1, 2017 onwards. In order to assess the effect of tax rate increase on French equities, the DiD model was considered with already taxed firms (STT) as the treated group. We consider two control groups: (i) French non-taxed firms (*FR, no STT*) and (ii) Foreign non-taxed firms (*no FR, no STT*). According to the previous studies, we might expect a reduction in trading (value and volume), albeit to a lower extent compared to 2012 since the increase in transaction costs is - in absolute terms - halved (the introduction of the tax add 0.2% compared to 0.1% in 2017). It can also reasonably be expected to have any particular effect on spreads, illiquidity and volatility.

10. Some exceptions could be mentioned. Indeed, in 2015 and 2017 we observe a possible increase of the Corwin-Schultz spread. Reciprocally, we can also notice a decrease of the trading value in 2018.

Results are presented in Table 3.7. It seems that there was a small decrease in market activity in 2017 for taxed firms compared to non-taxed firms, albeit the result is only significant at the 10% level for trading volume, and not-significant for trading value. As expected, if we consider only French firms, the decrease is on a smaller scale than in 2012 with a coefficient equal to -0.14 compare to -0.23 in Table 3.5. The impact on the bid-ask spread is unclear since the coefficient related to the relative spread is positive and significant, but our proxy using the Corwin-Schultz method is not. Similarly, our illiquidity ratio increase, but at the same time, the high-low range decrease.

3.3.3 Whole period impact after the introduction

In this section, we test the average impact of the French STT over the whole period. Indeed, the DiD method is a special case of a more general approach where fixed effect panel model are used to evaluate policy changes. Therefore, our fixed effect panel specification (equation 3.2.4, section 3.2.4) exploit the principal strengths of our dataset, with its large sample size and the fact that it covers a long period of time (i.e. 2013-2019) so as to obtain the average impact over the whole period.

Table 3.8 show the result of the fixed affect model that allow to control for unobserved heterogeneity with individual and time fixed effects over the whole period of 2013-2019. Individual effects take into consideration firm-specific effects while time fixed effect account for trend effects common to all firms. Overall, once again, the impact of the French STT appears to be not significant. The only variable significant at the 5% level is trading value and it is positive. Contrary to the concerns often expressed against the STT, our results suggest that the French STT did not have a damaging effect on stocks.

Table 3.5: DiD results: Yearly impact of being taxed

This table presents Difference-in-Difference econometric tests. Models are estimated on 3 months before and 3 months after the introduction of the STT every year. In column (1), we present results for new taxed vs non-taxed firms whereas in columns (2) we present results for new taxed vs already taxed firms. Time and firms dummies are included, but not reported. Robust standard errors are clustered at the firm level. $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value in thousand € respectively. $Spread_{i,t} = 2{*}100{*}(Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$ where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100 * (2 * (exp(\alpha_t) - 1))/((1 + exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3 - 2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3 - 2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t where $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. Illiquidity ratio is expressed in € million of trades for a price change of 1%. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4 * ln(2))$ is a proxy of volatility.

		$V_{i,t}$		$TV_{i,t}$		$Spread_{i,t}$		$ECS_{i,t}$		$Illiq_{i,t}$		$HLR_{i,t}$	
	Control group	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
2012	STT	-0.227***	-	-0.141**	-	0.100*	-	0.025	-	-0.011	-	0.001	-
	t-stat	(-3.50)	-	(-2.29)	-	(1.97)	-	(0.45)	-	(-0.56)	-	(0.33)	-
	Obs. [T/C]	18,701 [106/41]	-	18,936 [106/41]	-	19,066 [106/41]	-	11,309 [106/41]	-	18,936 [106/41]	-	19,013 [106/41]	-
2013	STT	0.240	0.346***	0.294	0.417***	-0.002	-0.000	0.382***	0.295***	0.005*	-0.000	0.011	0.007***
	t-stat	(1.55)	(3.24)	(1.69)	(3.56)	(-0.04)	(-0.02)	(4.03)	(3.70)	(1.79)	(-0.06)	(1.71)	(2.78)
	Obs. [T/C]	1,750 [5/9]	4,248 [5/29]	1,750 [5/9]	4,250 [5/29]	1,750 [5/9]	4,250 [5/29]	1,049 [5/9]	2,532 [5/29]	1,750 [5/9]	4,250 [5/29]	1,750 [5/9]	4,250 [5/29]
2014	STT	0.012	-0.025	0.046	0.005	-0.034	-0.027	-0.100	-0.114	-0.001	0.001	0.004	0.003
	t-stat	(0.09)	(-0.26)	(0.31)	(0.04)	(-0.67)	(-0.84)	(-1.08)	(-1.50)	(-0.15)	(0.40)	(1.38)	(1.02)
	Obs. [T/C]	1,957 [9/7]	4,252 [9/25]	1,957 [9/7]	4,252 [9/25]	1,957 [9/7]	4,252 [9/25]	1,165 [9/7]	2,495 [9/25]	1,957 [9/7]	4,252 [9/25]	1,957 [9/7]	4,252 [9/25]
2015	STT	0.107	-0.004	0.046	0.013	-0.043	-0.079	0.183	-0.015	-0.004	0.001	-0.005	0.003
	t-stat	(0.58)	(-0.03)	(0.26)	(0.10)	(-0.40)	(-0.89)	(1.59)	(-0.19)	(-0.75)	(0.12)	(-0.40)	(0.95)
	Obs. [T/C]	2,033 [8/8]	4,864 [8/30]	2,033 [8/8]	4,864 [8/30]	2,033 [8/8]	4,864 [8/30]	1,237 [8/8]	2,855 [8/30]	2,033 [8/8]	4,864 [8/30]	2,033 [8/8]	4,864 [8/30]
2016	STT	-0.218	-0.214**	-0.238	-0.243**	-0.059	-0.052	-0.023	-0.208	0.001	0.007	-0.003	-0.004
	t-stat	(-1.49)	(-2.36)	(-1.49)	(-2.17)	(-0.90)	(-0.93)	(-0.13)	(-1.31)	(0.18)	(0.86)	(-0.52)	(-0.84)
	Obs. [T/C]	2,821 [8/15]	4,032 [8/24]	2,821 [8/15]	4,033 [8/24]	2,827 [8/15]	4,034 [8/24]	1,682 [8/15]	2,280 [8/24]	2,821 [8/15]	4,033 [8/24]	2,821 [8/15]	4,033 [8/24]
2017	STT	0.212	0.130	0.017	0.047	0.132	0.068**	-0.061	-0.009	0.000	0.003	-0.006	0.000
	t-stat	(1.09)	(1.17)	(0.07)	(0.43)	(1.49)	(2.41)	(-0.47)	(-0.12)	(0.12)	(0.86)	(-1.28)	(0.17)
	Obs. [T/C]	1,792 [5/9]	4,603 [5/31]	1,792 [5/9]	4,607 [5/31]	1,792 [5/9]	4,607 [5/31]	1,105 [5/9]	2,786 [5/31]	1,792 [5/9]	4,607 [5/31]	1,792 [5/9]	4,607 [5/31]
2018	STT	0.079	-0.019	0.073	-0.014	-0.031	-0.038	-0.198	-0.121	-0.006**	0.001	-0.006**	-0.007**
	t-stat	(0.47)	(-0.11)	(0.43)	(-0.08)	(-0.77)	(-1.23)	(-1.52)	(-0.95)	(-2.12)	(0.26)	(-2.12)	(-2.24)
	Obs. [T/C]	3,386 [10/17]	4,522 [10/26]	3,386 [10/17]	4,522 [10/26]	3,388 [10/17]	4,522 [10/26]	1,964 [10/17]	2,627 [10/26]	3,386 [10/17]	4,522 [10/26]	3,386 [10/17]	4,522 [10/26]
2019	STT	-0.277	-0.306*	-0.272	-0.348	-0.022	-0.051	0.131	0.184	0.002	0.004	0.008	0.004
	t-stat	(-1.21)	(-1.72)	(-1.21)	(-1.68)	(-0.16)	(-0.39)	(0.69)	(1.10)	(0.48)	(0.94)	(1.25)	(1.18)
	Obs. [T/C]	1,639 [3/10]	3,925 [3/28]	1,639 [3/10]	3,925 [3/28]	1,639 [3/10]	3,925 [3/28]	973 [3/10]	2,172 [3/28]	1,638 [3/10]	3,924 [3/28]	1,639 [3/10]	3,925 [3/28]

Note: t-statistics are in (); The number of treated/control firms are in []; * , ** , *** indicates a coefficient statistically different from zero at the 10%, 5%, 1% level, respectively.

Table 3.6: DiD results: Yearly impact of being no more taxed

This table presents Difference-in-Difference econometric tests. Models are estimated on 3 months before and 3 months after the introduction of the STT every year. In column (1), we present results for no longer taxed vs non-taxed firms whereas in columns (2) we present results for no longer taxed vs already taxed firms. Time and firms dummies are included, but not reported. Robust standard errors are clustered at the firm level. $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value in thousand € respectively. $Spread_{i,t} = 2 * 100 * (Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$ where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100 * (2 * (exp(\alpha_t) - 1))/((1 + exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3 - 2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3 - 2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t where $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. Illiquidity ratio is expressed in € million of trades for a price change of 1%. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4 * ln(2))$ is a proxy of volatility.

		$V_{i,t}$		$TV_{i,t}$		$Spread_{i,t}$		$ECS_{i,t}$		$Illiq_{i,t}$		$HLR_{i,t}$	
	Control group	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
2015	STT	0.247	0.136*	-0.101	-0.135*	0.040	0.005	0.690***	0.492***	0.005	0.010**	-0.003	0.005*
	t-stat	(1.63)	(2.00)	(-0.71)	(-1.96)	(0.63)	(0.23)	(7.36)	(12.73)	(1.68)	(2.08)	(-0.26)	(1.85)
	Obs. [T/C]	1,137 [1/8]	3,968 [1/30]	1,137 [1/8]	3,968 [1/30]	1,137 [1/8]	3,968 [1/30]	691 [1/8]	2,309 [1/30]	1,137 [1/8]	3,968 [1/30]	1,137 [1/8]	3,968 [1/30]
2016	STT	0.205	0.210	0.048	0.043	0.255	0.262	0.523**	0.338	-0.001	0.005	0.024	0.023
	t-stat	(1.10)	(1.45)	(0.27)	(0.32)	(1.33)	(1.40)	(2.36)	(1.61)	(-0.28)	(0.71)	(1.23)	(1.22)
	Obs. [T/C]	2,597 [6/15]	3,808 [6/24]	2,597 [6/15]	3,809 [6/24]	2,603 [6/15]	3,810 [6/24]	1,529 [6/15]	2,127 [6/24]	2,597 [6/15]	3,809 [6/24]	2,597 [6/15]	3,809 [6/24]
2017	STT	0.080	-0.002	-0.017	0.013	0.207**	0.143***	-0.168	-0.115***	-0.002	0.001	-0.008*	-0.002***
	t-stat	(0.47)	(-0.04)	(-0.08)	(0.21)	(2.33)	(5.53)	(-1.50)	(-3.90)	(-0.49)	(0.39)	(-1.88)	(-3.25)
	Obs. [T/C]	1,280 [1/9]	4,091 [1/31]	1,280 [1/9]	4,095 [1/31]	1,280 [1/9]	4,095 [1/31]	802 [1/9]	2,483 [1/31]	1,280 [1/9]	4,095 [1/31]	1,280 [1/9]	4,095 [1/31]
2018	STT	-0.097	-0.195	-0.177**	-0.265***	-0.021	-0.027	0.049	0.125	-0.003	0.003	0.001	-0.000
	t-stat	(-0.84)	(-1.69)	(-2.54)	(-4.19)	(-0.36)	(-0.55)	(0.35)	(0.92)	(-1.14)	(1.30)	(0.40)	(-0.00)
	Obs. [T/C]	2392 [2/17]	3528 [2/26]	2392 [2/17]	3528 [2/26]	2394 [2/17]	3528 [2/26]	1367 [2/17]	2030 [2/26]	2392 [2/17]	3528 [2/26]	2392 [2/17]	3528 [2/26]
2019	STT	0.073	0.044	0.017	-0.058	0.033	0.004	-0.014	0.039	-0.001	0.001	-0.013	-0.017
	t-stat	(0.43)	(0.44)	(0.12)	(-0.50)	(1.15)	(0.22)	(-0.07)	(0.23)	(-0.28)	(1.17)	(-1.04)	(-1.52)
	Obs. [T/V]	1,778 [4/10]	4,064 [4/28]	1,778 [4/10]	4,064 [4/28]	1,778 [4/10]	4,064 [4/28]	995 [4/10]	2,194 [4/28]	1,778 [4/10]	4,064 [4/28]	1,778 [4/10]	4,064 [4/28]

Note: t-statistics are in (); * , ** , *** indicates a coefficient statistically different from zero at the 10%, 5%, 1% level, respectively.

Table 3.7: DiD results: Impact of tax rate increase

This table presents Difference-in-Difference econometric tests. Models are estimated on 3 months before and 3 months after the tax rate update on January 1, 2017. In column (1), we present results for no longer taxed vs non-taxed firms whereas in columns (2) we present results for no longer taxed vs already taxed firms. Time and firms dummies are included, but not reported. Robust standard errors are clustered at the firm level. $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value in thousand € respectively. $Spread_{i,t} = 2 * 100 * (Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$ where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100*(2*(exp(\alpha_t)-1))/((1+exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3-2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3-2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t where $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. Illiquidity ratio is expressed in € million of trades for a price change of 1%. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4*ln(2))$ is a proxy of volatility.

Variable	control group	STT	[# taxed/non taxed]	Obs.
$V_{i,t}$	*FR, no STT*	-0.142*	[118/34]	19,533
		(-1.66)		
	No FR, no STT	-0.019	[118/65]	23,223
		(-0.26)		
	FR+no FR, no STT	-0.048	[118/99]	27,593
		(-1.04)		
$TV_{i,t}$	*FR, no STT*	-0.132	[118/34]	19,537
		(-1.45)		
	No FR, no STT	-0.106	[118/65]	23,227
		(-1.14)		
	FR+no FR, no STT	-0.101*	[118/99]	27,597
		(-1.76)		
$Spread_{i,t}$	*FR, no STT*	0.072**	[118/34]	19,542
		(2.07)		
	No FR, no STT	-0.004	[118/65]	23,227
		(-0.39)		
	FR+no FR, no STT	0.021	[118/99]	27,602
		(1.36)		
$ECS_{i,t}$	*FR, no STT*	-0.058	[118/34]	11,860
		(-1.18)		
	No FR, no STT	0.037	[118/65]	13,889
		(1.00)		
	FR+no FR, no STT	0.004	[118/99]	16,648
		(0.13)		
$Illiq_{i,t}$	*FR, no STT*	0.005**	[118/34]	19,537
		(2.18)		
	No FR, no STT	-0.001	[118/65]	23,227
		(-1.20)		
	FR+no FR, no STT	0.001	[118/99]	27,597
		(0.62)		
$HLR_{i,t}$	*FR, no STT*	-0.004**	[118/34]	19,537
		(-1.98)		
	No FR, no STT	-0.000	[118/65]	23,227
		(-0.09)		
	FR+no FR, no STT	-0.002	[118/99]	27,597
		(-1.38)		

Note: t-statistics are in (); * , ** , *** indicates a coefficient statistically different from zero at the 10%, 5%, 1% level, respectively.

Table 3.8: Estimation results: whole period

This table presents fixed effect econometric test. Model 3.2.4 defined in section 3.2.4 is estimated from October 2012 to March 2019. In column (1), we present results for the model without specific trend whereas in columns (2) we present results for the model with specific trend. Time and firms dummies are included, but not reported. Robust standard errors are clustered at the firm level. $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value in thousand € respectively. $Spread_{i,t} = 2 * 100 * (Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$ where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100 * (2 * (exp(\alpha_t) - 1))/((1 + exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3 - 2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3 - 2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t where $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. Illiquidity ratio is expressed in € million of trades for a price change of 1%. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4 * ln(2))$ is a proxy of volatility.

	$V_{i,t}$		$TV_{i,t}$		$Spread_{i,t}$		$ECS_{i,t}$		$Illiq_{i,t}$		$HLR_{i,t}$	
Model	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
STT	-0.047	-0.137**	0.475***	0.075	-0.121***	-0.079**	-0.123***	-0.144***	-0.000***	-0.000	-0.005***	-0.006***
t-stat	(-0.50)	(-2.05)	(4.36)	(1.08)	(-3.52)	(-2.10)	(-3.05)	(-2.64)	(-2.71)	(-0.70)	(-3.12)	(-2.73)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm specific trend	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Adj. R2	0.86	0.88	0.74	0.78	0.25	0.29	0.19	0.21	0.09	0.10	0.11	0.12
Obs.	94,731	94,731	94,811	94,811	94,819	94,819	56,056	56,056	94,811	94,811	94,863	94,863

Note: t-statistics are in (); * , ** , *** indicates a coefficient statistically different from zero at the 10%, 5%, 1% level, respectively.

3.4 Conclusion

This paper tried to shed new light on the link between STT and stock market quality by conducting a more detailed analysis of French case over the 2012-2019 period. We rely on two estimation strategy: Difference-in-Difference and fixed effect panel. Regardless of the estimation strategy, our results show that the introduction of the STT has reduced activity only in 2012. Other measures of liquidity, such as bid-ask spread, ECS and price impact have no impact. As to volatility, measured by the high-low range, the results are insignificant. To sum up, our investigation shows that the French STT has a limited impact on the financial markets through the period.

3.5 Appendix

Table 3.9: Summary of the impact assessments of the French STT

	Colliard and Hoffmann (2017)	Capelle-Blancard and Havrylchyk (2016)	Gomber et al. (2015)	Meyer et al. (2015)	Becchetti et al. (2014)
Period (surrounding the event)	5 months	1 year	20/80 trading days	80 trading days	90 trading days
Data (source and type)	Thomson Reuters: tick data (Euronext)	Thomson Reuters: daily data (Euronext & Deutsche Boerse)	Thomson Reuters: tick data (Euronext & Chi-X)	Thomson Reuters: tick data (Euronext & Chi-X)	Bloomberg: daily data (Paris Bourse)
Sample (# firms, treated/control)	87 French/32 Dutch & Lux. + 29 non-treated French +18 French midcaps	88 French/106 foreign +49 French midcaps	36 French blue chips/30 German blue chips	94 French/99 UK	106 French/220 French midcaps and small-caps
Methodology	DiD	DiD, PSM, RD	DiD	DiD, Matching	Non parametric individual tests, DiD, RD
Robustness and sub-samples	20 stocks above and 20 stocks below the threshold	Alternative proxies, Impact over time, German firms as a control group, all transactions (regulated exchanges + MTFs + OTC)	Clusters by market capitalization and price level	Size effect	
DiD results					
Traded value	-	-	Not significant	-	
Nb of trades			-		
Turnover		-			-
Frequency of quotes				-	
Spread	Not significant	Not significant	+	Not significant	Not significant
Depth	-		-	-	
Low-latency	-				
Price impact				Not significant	
Liquidity ratio		Not significant			Not significant
Price reversal		Not significant			
Standard deviation			Not significant		
Squared returns		Not significant			
Conditional variance		Not significant			
Daily high-low range	Not significant	Not significant	Not significant		-
Realized volatility	Not significant		Not significant		
Price dispersion			+		

Table 3.10: Descriptive statistics of the original sample

This table provides descriptive statistics of the French stocks included in the Euronext 100 and Next 150 indexes, as well as taxed firms not included in the indexes (excluding 5 firms that have experienced a takeover bid or not listed on Euronext Paris). The sample period extends from May 2012 to March 2019 (1,803 trading days). All the data are daily. $Close_{it}$ is the closing price for the stock i on the day t. $Spread_{i,t} = 2*100*(Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$, where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100 * (2 * (exp(\alpha_t) - 1))/((1 + exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3 - 2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3 - 2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4 * ln(2))$ is a proxy of volatility. $Volume_{it}$ and $Value_{it}$ are the trading volume in thousands and the trading value and thousand € respectively. $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value and thousand € respectively. MV_{it} is the market value of the stock i on the day t in million €. $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t. Illiquidity ratio is expressed in € million of trades for a price change of 1%.

Variable	Obs.	Mean	Std. Dev.	Min	Max
$Close_{it}$(€)	429,717	129.08	652.72	0.12	9,950.00
$Spread_{i,t}$ (%)	393,851	0.71	2.32	-26.50	199.99
$ECS_{i,t}$ (%)	226,661	0.95	0.94	0.00	20.00
$HLR_{i,t}$	387,897	0.01	0.05	0.00	10.20
$Volume_{it}$ (thousand)	387,897	649	2,379	0	193,086
$Value_{it}$ (thousand €)	387,758	17,015	42,449	0	1,644,350
$V_{i,t}$ (thousand. log)	379,710	10.92	2.60	4.61	19.08
$TV_{i,t}$ (thousand €. log)	385,858	14.11	2.75	4.61	21.22
MV_{it} (million €)	427,914	7,161	15,723	0	165,598
$Return_{it}$ (%)	429,695	0.00	0.02	-1.26	0.73
$Illiq_{i,t}$ (million €)	385,856	0.24	5.65	0.00	2,070.14

Table 3.11: Correlation matrix between market liquidity and volatility measures

This table provides pairwise correlation coefficients for the liquidity and the volatility measures. The sample period extends from May 2012 to March 2019 (1,803 trading days). $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value in thousand € respectively. $Spread_{i,t} = 2 * 100 * (Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$ where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100*(2*(exp(\alpha_t)-1))/((1+exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3-2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3-2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t where $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. Illiquidity ratio is expressed in € million of trades for a price change of 1%. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4*ln(2))$ is a proxy of volatility.

	$V_{i,t}$	$TV_{i,t}$	$Spread_{i,t}$	$ECS_{i,t}$	$Illiq_{i,t}$	$HLR_{i,t}$
$V_{i,t}$	1.0000					
$TV_{i,t}$	0.9765***	1.0000				
$Spread_{i,t}$	-0.4222***	-0.4302***	1.0000			
$ECS_{i,t}$	-0.3005***	-0.3841***	0.3235***	1.0000***		
$Illiq_{i,t}$	-0.5232***	-0.5687***	0.3723***	0.3838***	1.0000	
$HLR_{i,t}$	-0.2664***	-0.3429***	0.3032***	0.5259***	0.4200***	1.0000

* , ** , *** a correlation statistically different from zero at the 10%, 5%, and 1%, respectively.

Table 3.12: Correlation matrix between taxed and non-taxed companies

This table reports pairwise correlation coefficients for the measures of liquidity and volatility between taxed (STT) and non taxed companies (No STT). Correlation coefficients are computed for the whole period (from May 2012 to March 2019) and for each sub-period (from October $N-1$ to March N, $N = 2012, ..., 2019$). Unsurprisingly, all coefficients are significantly different from zero (unless between daily spread in 2013 and 2014). All the data are daily. $V_{i,t} = ln(Volume_{it})$ and $TV_{i,t} = ln(Value_{it})$ measure the logarithm of trading volume in thousands and the logarithm of trading value in thousand € respectively. $Spread_{i,t} = 2 * 100 * (Ask_{i,t} - Bid_{i,t})/(Ask_{i,t} + Bid_{i,t})$ where Ask_{it} and Bid_{it} are the ask and bid prices for the stock i on the day t respectively. Corwin-Schultz spread, $ECS_{i,t} = 100 * (2 * (exp(\alpha_t) - 1))/((1 + exp(\alpha_t)))$ with $\alpha_{i,t} = (\sqrt{2\beta_{i,t}} - \sqrt{\beta_{i,t}})/(3-2\sqrt{2}) - \sqrt{(\gamma_{i,t})/(3-2\sqrt{2})}$, $\beta_{i,t} = 1/2[(h_{i,t+1} - l_{i,t+1})^2 + (h_{i,t} - l_{i,t})^2]$ and $\gamma_{i,t} = (max(h_{i,t+1}, h_{i,t}) - min(l_{i,t+1}, l_{i,t}))$, where h_{it} and l_{it} are highest price and the lowest price achieved for the stock i on the day t respectively. $Illiq_{i,t} = |Return_{i,t}|/(Value_{i,t}/1000)$ is the Amihud illiquidity ratio for the stock i on the day t where $Return_{it}$ is the continuously computed return $Return_{i,t} = ln(Close_{i,t}/Close_{i,t-1})$. Illiquidity ratio is expressed in € million of trades for a price change of 1%. High-low range, $HLR_{i,t} = (ln(h_{it}) - ln(l_{it}))/(4 * ln(2))$ is a proxy of volatility.

$Corr(STT, NoSTT)$	2012	2013	2014	2015	2016	2017	2018	2019	Whole period
V_t	0.60***	0.48***	0.66***	0.71***	0.70***	0.39***	0.67***	0.49***	0.45***
TV_t	0.68***	0.46***	0.65***	0.77***	0.69***	0.32***	0.67***	0.47***	0.50***
$Spread_t$	0.22***	-0.01	0.03	0.16***	0.32***	0.61***	0.46***	0.16*	0.27***
ECS_t	0.60***	0.40***	0.61***	0.42***	0.77***	0.38***	0.68***	0.49***	0.59***
LR_t	0.67***	0.62***	0.64***	0.64***	0.70***	0.48***	0.74***	0.63***	0.64***
HLR_t	0.57***	0.40***	0.69***	0.46***	0.85***	0.18***	0.63***	0.25***	0.63***

*, **, *** a correlation statistically different from zero at the 10%, 5%, and 1%, respectively. In 2012, N is August an $N-1$ is July 2012.

Chapter 4

Conclusion

La question de l'efficacité de la TTF remonte à Keynes (1936). Il soutient qu'une telle taxe pourrait diminuer, par exemple, la spéculation boursière. Plusieurs décennies plus tard, James Tobin (1978) a proposé une taxe sur les transactions de change qui a suscité beaucoup d'intérêt et ferveur auprès de nombreux chercheurs. Le débat reste encore ouvert même aujourd'hui, surtout depuis la crise financière de 2008. Dans ce contexte, cette thèse s'articule autour de 3 chapitres qui évaluent sous différents angles l'impact de la TTF sur la qualité des marchés financiers. Nous nous intéressons tout d'abord à la taxation des produits dérivés, en prenant exemple sur le cas très singulier du marché coréen (Chapitres 1 et 2). Nous examinons également le cas du marché des actions en France et proposons une analyse sur une longue période (Chapitre 3).

Le premier chapitre évalue l'impact de la hausse du multiplicateur des options du KOSPI 200 sur le marché des produits dérivés entre 2011 et 2012. Les résultats montrent que la hausse du multiplicateur a provoqué une baisse des volumes de 80% environ. Une fois que nous avions constaté cette baisse drastique, nous avons analysé la réaction du marché sur : i) la distribution des parts des différents types de traders, ii) la liquidité et iii) la volatilité. Les résultats confirment que les transactions des investisseurs individuels (noise traders) ont été réduite, passant de 31% à 27%. A l'inverse, la part des investisseurs institutionnels et étrangers (professionnels) dans le total des transaction a augmenté d'environ 4 points. La composition des traders du marché des options se retrouve modifiée suite à la hausse du multiplicateur. Toutefois, étant donné que les changements concernant : i) la répartition des types de traders sont relativement faible et ii) la forte baisse des volume en valeur est drastique, il semble ardue d'affirmer avec cette simple analyse descriptive si l'effet composition l'emporte sur l'effet liquidité. Afin de se prononcer sur lequel de ces deux effets l'emporte, nous menons une analyse quant à l'évolution de la volatilité et de

l'asymétrie de la volatilité. Nos résultats montrent une faible réduction de l'asymétrie ainsi que de la volatilité, même si elle est statistiquement significative. Cette légère baisse confirme que l'effet de composition l'emporte sur celui de la liquidité. Ce qui est conforme et en accord avec les arguments de la littérature théorique quant à l'importance de l'effet composition.

Dans le deuxième chapitre, nous examinons l'impact de la taxe sur les gains en capital sur le marché des options coréen. Nous utilisons diverses mesures de la liquidité du marché : le volume des transactions, la valeur des transactions, le nombre de positions ouvertes, et le bid-ask spread. La taxe a été imposée pour les contrats KOSPI 200 en janvier 2016 et les MINI KOSPI 200 en juillet 2016. Ce délais de 6 mois a facilité l'étude de l'effet causal de l'introduction de la CGT en utilisant la méthode des doubles différences. Les résultats de l'analyse montrent que l'introduction de la CGT sur le marché des produits dérivés coréen a réduit le volume et la valeur des transactions, mais qu'elle n'a pas eu d'effet significatif sur le bid-ask spread. Par contre, nous avons constaté un transfert de l'activité de trading : i) des investisseurs individuels vers les investisseurs institutionnels (qui sont exemptés de la taxe), et ii) du KOSPI 200 vers les MINI KOSPI 200. Ce dernier transfère valide l'hypothèse du mécanisme des paradis fiscaux. En effet, les traders quittent le marché taxé vers le marché qui n'est pas taxé. Alors que faudrait-il faire pour parer à ces comportements ?

Pour répondre à cette question, nous avons un projet en cours afin de modéliser théoriquement les comportements des différents types de traders en partant du modèle de Glosten-Milgrom (1985). Notre modèle postule deux marchés : le marché des actions versus le marché des produits dérivés de ces mêmes actions. Les traders peuvent choisir sur quel marché négocier, sachant quel seul le marché des actions est taxé. Nous pensons trouver que l'introduction de la taxe sur un seul marché entraînera une forte diminution du volume des échanges sur le marché taxé. Nous nous attendons aussi à une augmentation (baisse) de la volatilité sur le marché taxé en fonction de la hausse (baisse) de la part des noise traders. Nous tenons à souligner que taxer seulement les actions offre la possibilité aux investisseurs de se tourner vers des instruments non taxés (tel que les produits dérivés). Il semblerait judicieux de cibler les deux marchés mais surtout cibler mieux les acteurs qui font de la spéculation (noise traders).

Dans le troisième et dernier chapitre, nous évaluons l'impact de la TTF française sur la liquidité et la volatilité du marché. Contrairement aux études précédentes, le format de la TTF nous permet de tester son effet sur une plus longue période (2012-2019). Les résultats montrent que l'impact négatif de la TTF sur l'activité du marché ne s'est produit qu'au moment de l'introduction de la taxe en août 2012. Depuis, les nouvelles entreprises taxées n'ont pas connu de diminution de la

liquidité, quelle que soit la façon dont elle est mesurée, et les entreprises qui ne sont plus taxées n'ont pas bénéficié d'une amélioration de la liquidité. L'augmentation du taux d'imposition en 2017 (de 0,2 à 0,3%) n'a pas non plus eu d'impact significatif. Dans l'ensemble, contrairement aux inquiétudes exprimées avant son introduction, la TTF ne semble pas avoir été préjudiciable au marché boursier français.

En pratique, l'effet de la TTF et de toute hausse des coûts de transaction est modeste pour tout type de marché. Notre recherche montre globalement une baisse des volumes de transaction à court terme. En pratique, donc, la TTF ne limite guère la croissance des marchés financiers ; au plus, ralentit-elle cet essor de quelques trimestres. Il y a, en outre, très peu de signes d'un impact significatif sur le spread des actifs financiers. La TTF, du moins telle qu'elle est pratiquée aujourd'hui, ne semble pas non plus avoir d'effet sur la volatilité des marchés – ni à la hausse, ni à la baisse (ou très peu). Le design de la TTF est évidemment crucial. Les craintes concernant une possible délocalisation de l'activité financière paraissent toutefois exagérées. Le double principe d'émission et de résidence crée les conditions d'une taxe applicable très largement, quelle que soit l'origine de la transaction. Aujourd'hui, la plupart des TTF ne s'appliquent qu'aux marchés des actions, ce qui exclut de fait les transactions intra-journalières. Entre 80% à 90% des transactions apparaissent ainsi exemptés de la TTF en France ou au Royaume-Uni. Taxer les transactions intra-journalières nécessite de revoir en profondeur le dispositif de collecte pour disposer d'une information fiable sur les transactions, y compris les transactions à haute-fréquence et/ou celles réalisées sur les plateformes de négociation alternatives. Il s'avère, au final, que la TTF présente les atouts qui font un bon impôt : la TTF est peu distorsive, les recettes fiscales sont potentiellement élevées et les frais de recouvrement minimes ; elle a en outre un effet redistributif. L'équivalent du stamp duty britannique étendu aux principaux pays du monde, permettrait de lever, malgré ses très nombreuses exemptions, 100 milliards de dollars par an. L'étendre aux instruments dérivés et aux transactions intra-journalières apporterait des recettes supplémentaires, tout en améliorant la transparence sur les marchés financiers.

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Abstract

The last decade has been marked by several new regulations in response to the 2007-2008 financial crisis. In order to contribute to the debate, this thesis consists of three chapters that address different aspects of the regulation of stock and derivatives markets. The first chapter provides an assessment of the impact of the increase of the option multiplier of the KOSPI 200 on investor participation and market efficiency for the period 2011-2013. We use two measures of market efficiency : the participation share of noise traders and asymmetric volatility. In the second Chapter we examinee the impact of the Capital Gains Tax (CGT) on the quality and efficiency of the KOSPI 200 options market. We use various measures of market liquidity : trading volume, trading value, and the bid-ask spread over the period August 2015 to December 2016. The third chapter assesses the impact of the French Security Transaction Tax (STT) on market liquidity and volatility. Contrary to previous studies, the format of the French STT allows us to test its effect over a longer period 2012-2019.

Keywords : Financial tax transaction, Financial regulation, Market efficiency, Derivatives markets, Stock markets.

Résumé

La dernière décennie a été marquée par plusieurs nouvelles réglementations en réponse à la crise financières de 2007-2008. Afin de contribuer au débat, cette thèse se compose de trois chapitres qui abordent différents aspects de la réglementation des marchés boursiers et dérivés. Le premier chapitre fournit une évaluation claire de l'impact de la hausse du multiplicateur des options du KOSPI 200 sur la participation des investisseurs et l'efficacité du marché pour la période 2011-2013. Nous utilisons deux mesures de l'efficacité du marché : la part de participation des noise traders et la volatilité asymétrique. Dans la même perspective, le chapitre 2 examine l'impact de la taxe sur les gains en capital (CGT) sur la qualité et l'efficience du marché des options du KOSPI 200 . Nous utilisons diverses mesures de la liquidité du marché : le volume des transactions, la valeur des transactions, et l'écart de prix entre les cours acheteur et vendeur sur la période d'août 2015 à décembre 2016. Le troisième chapitre évalue l'impact de la taxe sur les transactions financières (STT) française sur la liquidité et la volatilité du marché. Contrairement aux études précédentes, le format de la STT Française nous permet de tester son effet sur une plus longue période 2012-2019.

Mots-clés : Taxe sur les transactions financières, Régulation financière, Efficience des marchés, Marchés des produits dérivés, Marchés des actions.