ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
UNIVERSITY OF CRETE

Essays in Corporate Governance and Labor Relations. A Game–Theoretic Approach.

A DISSERTATION PRESENTED
BY
Panagiotis Skartados
TO
The Department of Economics

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
Doctor of Philosophy
IN THE SUBJECT OF
Economics.

University of Crete
Rethymno, Crete
July 2018

Thesis Advisor: Petrakis Emmanuel
Professor, Department of Economics, University of Crete, petrakis@uoc.gr

Advisory Committee Member: Chrysovalantou Milliou
Associate Professor, Department of International & European Economic Studies, Athens University of Economics and Business, cmilliou@aueb.gr

Advisory Committee Member: Stamatopoulos Georgios
Associate Professor, Department of Economics, University of Crete, gstamato@uoc.gr

Thesis advisor: Professor Emmanuel Petrakis Panagiotis Skartados

Essays in Corporate Governance and Labor Relations. A Game–Theoretic Approach.

Abstract

This PhD Thesis is written and submitted to the Department of Economics of the University of Crete, Greece, as a partial fulfillment of my obligations as a PhD Candidate. It consists of three chapters dealing with the corporate governance and the labor relations in vertically related markets.

In Chapter 1, we deal with the strategic profit–sharing in a unionized differentiated duopoly. We study firms' incentives to offer profit-sharing schemes in a unionized differentiated goods duopoly in which firms bargain with a sector-wide union or firm-specific unions over the selected remuneration schemes. We show that unions always prefer to form a sector-wide union and conduct coordinated bargaining. Under Cournot competition, ex-ante symmetric firms may choose to offer different remuneration schemes under coordinated bargaining and become ex-post asymmetric. Moreover, universal profit-sharing schemes arise as long as the union's bargaining power is low enough. In contrast, under Bertrand competition, firms never offer profit-sharing schemes and universal fixed wage schemes is the unique equilibrium. Our welfare analysis indicates that policymakers should institutionalize decentralized bargaining and encourage profit-sharing schemes.

In Chapter 2, we consider the strategic implications of the disclosure regime of vertical contract terms. The latter are used in the literature either as observable or as secret. We endogenize this decision and show that the mode and intensity of the downstream competition, as

well as the upstream market structure, play a significant role in the observability of the vertical contract terms. When a common supplier bargains with each retailer over a two-part tariff contract, interim observability intensifies the commitment problem, by offering a wholesale price below the marginal cost. The same holds under linear contracts or Bertrand competition. On the other hand, under dedicated suppliers, it is more profitable to bargain over interim unobservable contracts and through them to alleviate the commitment problem. Policymakers could increase the social welfare by encouraging interim observability (unobservability) when firms compete in quantities (prices). Monopolized upstream markets are more prone to have aligned incentives with the policymakers, especially if the downstream retailers compete over quantities.

Finally, in Chapter 3, we study the incentives for horizontal upstream mergers in a quantity–setting vertically related industry, under bargain and endogenous contract types. We show that the contract types used could have important consequences to the equilibrium market structure and vice versa. If it is the retailers who choose contract types, they share the same preferences as the policymakers and choose to offer two–part tariff contracts, leading the suppliers not to merge. This result has some obvious policy implications. If it is the suppliers who decide contract types, they prefer to merge and offer a partial forward vertical ownership scheme. Under Bertrand competition, there is always an upstream merger, but the common manufacturer will offer a two–part tariff contract for intermediate bargain power levels. For high bargain power levels, he will choose a partial forward vertical ownership scheme, while for low bargain power will suffer from negative profits. A policymaker, considering the maximization of the social welfare should consider the upstream merger and two–part tariff contracts.

Contents

Listing of figures

Dedicated to Anna

Acknowledgments

First and foremost, I would like to thank my PhD Advisor, Professor Emmanuel Petrakis for his continuous encouragement, guidance and help over the past four years. Along with Assistant Professors Chrysovalantou Milliou and Georgios Stamatopoulos, offered me valuable lessons, applicable both in science and life. Furthermore, I would like to thank, among too many, Constantine Manassakis, Maria Alipranti, Minas Vlassis, Konstantinos Serfes, Paolo Garella and Christos Constantatos for their most helpful comments, suggestions and notes. Also, all the participants of CRETE 2015, 2016, 2017 and 2018 conferences, as well as ASSET 2015, 2016 and ICMAIF 2016 for giving me the chance to present my work and receive some good feedback. Last, but not least, I would like to thank Lina and Penny Skartadou, Marilena Magoula, Anna Simnianaki and my little daughter Garyfallia for their most valuable support.

Short Bio

Panagiotis Skartados was born in 1985 in Athens, Greece. He is married and has two children. He holds a dual BSc/MSc degree in Applied Mathematics from the National Technical University of Athens (2007), a MSc in Accounting and Finance from the Athens University of Economics and Business (2011) and a PhD in Economics from the University of Crete (2018). He is interested in Mathematical Economics, Applied Game Theory, Industrial Organization and Labor Economics/Industrial Relations. E-mail: pskartados@gmail.com

Εκτεταμένη Περίληψη στα Ελληνικά

Κεφαλαιο 1. Στρατηγικη χρηση των σχηματων διανομης κερδων σε ενα δυοπωλιο διαφοροποιημενων αγαθων με συνδικατα

Τα *σχήματα διανομής κερδών*, με μια μορφή ή με άλλη, είναι σε ευρεία χρήση σε όλο τον κόσμο. Ένα τέτοιο σχήμα ορίζει ότι εκτός από τον μισθό, ένας εργαζόμενος έχει να λαμβάνει και ένα ποσοστό από τα κέρδη της εταιρείας. Στην πράξη, τα σχήματα διανομής κερδών είναι ιδιαίτερα πολύπλοκα (OECD, 1995). Μια έρευνα στις 1.250 μεγαλύτερες πολυεθνικές επιχειρήσεις παγκοσμίως έδειξε ότι το 33% αυτών χρησιμοποιούν κάποιου είδους σχήμα διανομής κερδών, ενώ ένα 11% σχεδίαζε να εισάγει ένα τέτοιο σχήμα άμεσα (Weeden et al., 1998). Οι Muller (2017) και Lorenzetti (2016) αναφέρουν πολλές περιπτώσεις μεγάλων αμερικάνικων εταιρειών που χρησιμοποιούν τέτοια σχήματα το έτος 2015. Η Ford Motors αμείβει κάθε έναν από τους 56.000 εργαζόμενους της με $9.300 στα πλαίσια ενός τέτοιου σχήματος, η General Motors αμείβει $11.000 κάθε εργαζόμενο, ενώ η Fiat Chrysler Automobiles αμείβει με $5.000 κάθε έναν από τους 40,000 εργαζόμενους της στα πλαίσια ενός τέτοιου σχήματος. Από την άλλη, η Delta Airlines, η Southwest και η United Continental Airlines έδωσαν στους εργαζόμενους τους πάνω από $1,5 δισεκατομμύριο σε σχήματα διανομής κερδών μέσα στο 2015. Η American Airlines ήταν η μόνη από τις *Big Four* αεροπορικές εταιρείες στις ΗΠΑ που δεν χρησιμοποιούσε σχήμα διανομής κερδών μέχρι το 2015, αλλά τον Μάρτιο του 2016 εισήγαγε ένα τέτοιο σχήμα, διανέμοντας ετησίως το 5% των κερδών της στους εργαζόμενους Carey (2016). Οι Kato and Morishima (2003) αναφέρουν ότι μια στις τέσσερις επιχειρήσεις που είναι εισηγμένες στο Χρηματιστήριο, χρησιμοποιούν κάποιο σχήμα διανομής κερδών, με τη συντριπτική πλειοψηφία αυτών να πληρώνουν σε μετρητά μια φορά ετησίως. Η Huawei, η μεγαλύτερη εταιρεία κατασκευής τηλεπικοινωνιακού εξοπλισμού παγκοσμίως, διανέμει όλα της τα κέρδη μέσω συστήματος διανομής κερδών στους υπαλλήλους της, με τον ιδρυτή της Zheng Fei να λαμβάνει το 1,4% των κερδών ετησίως και το υπόλοιπο να μοιράζεται ισομερώς σε 82.000 εργαζόμενους παγκοσμίως De Cremer and Tao (2015). Ο Blasi et al. (2016) αναφέρει ότι οι στρατηγικές παρακίνησης των εργαζομένων μέσα από σχήματα αμοιβών, όπως είναι και το σχήμα διανομής κερδών, μαζί με θετικές πρακτικές εσωτερικής διαχείρισης και εταιρική κουλτούρα, μπορούν να βοηθήσουν τις κερδοφόρες επιχειρήσεις να φτάσουν ακόμη υψηλότερα επίπεδα κερδών.

Ένα δεύτερο σημαντικό κομμάτι αυτού του Κεφαλαίου είναι η ύπαρξη συνδικάτων ως μοναδικών προμηθευτών εργασίας. Παρατηρούμε ότι σε παγκόσμιο επίπεδο υπάρχει πληθώρα δομής συνδικάτων αλλά και επιπέδου συνδικαλισμού. Με τον όρο ”δομή συνδικάτου” αναφερόμαστε στο αν το συνδικάτο δραστηριοποιείται σε επίπεδο επιχείρισης ή σε επίπεδο κλάδου (Haucap and Wey, 2004). Στην πρώτη περίπτωση, οι διαπραγματεύσεις γίνονται μεταξύ του επιχειρησιακού συνδικάτου και της επιχείρησης και συμφωνείται αποκλειστικά ο μισθός της επιχείρησης. Αυτές οι διαπραγματεύσεις ονομάζονται ”αποκεντρωμένες”. Τέτοιες διαπραγματεύσεις υφίστανται χαρακτηριστικά στις ΗΠΑ, Αυστραλία, Μ. Βρετανία, Ιαπωνία, Καναδάς και αλλού (Bronfenbrenner and Juravich, 2001). Εν αντιθέσει, ένα κλαδικό συνδικάτο διαπραγματεύεται ξεχωριστά με όλες τις επιχειρήσεις του κλάδου και συμφωνεί τον μισθό που θα λάβει ένας εργαζόμενος σε κάθε μια από αυτές, ο οποίος ενδεχομένως και να μην είναι ίδιος με μια άλλη επιχείρηση του κλάδου. Αυτές οι διαπραγματεύσεις ονομάζονται ”συντονισμένες”. Υπάρχει, τέλος, και μια τρίτη μορφή διαπραγμάτευσης, με την οποία δεν ασχολούμαστε σε αυτό το Κεφάλαιο και είναι οι ”κεντρικές” διαπραγματεύσεις, στις οποίες το κλαδικό συνδικάτο συμφωνεί έναν μισθό που ισχύει ο ίδιος για όλες τις επιχειρήσεις του κλάδου. Οι τελευταίες δυο μορφές διαπραγμάτευσης υφίστανται σχεδόν σε όλες τις χώρες της ζώνης του ευρώ (Γαλλία, Γερμανία, Ιταλία, Ισπανία κλπ) (Goeddeke, 2010). Από την άλλη πλευρά, με τον όρο ”επίπεδο συνδικαλισμού” αναφερόμαστε στο ποσοστό συμμετοχής των εργαζομένων σε συνδικάτα. Η τάση παγκοσμίως τα τελευταία είκοσι χρόνια είναι η μείωση του επιπέδου συνδικαλισμού (Ellguth et al., 2014). Μια πιθανή εξήγηση είναι το ότι οι αποκεντρωμένες διαπραγματεύσεις επιτρέπουν μεγαλύτερη ευελιξία και γρηγορότερη προσαρμογή των επιχειρήσεων στη παγκοσμιοποιημένη αγορά προϊόντος (Hübler and Meyer, 2000). Μια άλλη πιθανή εξήγηση είναι το ότι καθώς μειώνεται η απασχόληση στον Δημόσιο/Κρατικό τομέα και αυξάνεται η απασχόληση στον Ιδιωτικό τομέα (μέσω π.χ. πολιτικών απορρύθμισης και ιδιωτικοποιήσεων κρατικών φορέων και εταιρειών), τόσο μειώνεται η δύναμη των συνδικάτων, παρέχοντας λιγότερα κίνητρα σε νέους εργαζόμενους να εγγραφούν σε αυτά (Pontusson, 2013). Παρ' όλα αυτά, τα επίπεδα συνδικαλισμού κινούνται ακόμη σε υψηλά επίπεδα: (α)πάνω από 50% των εργαζομένων είναι εγγεγραμμένοι σε συνδικάτα στην Ισλανδία, Βέλγιο, Φινλανδία, Δανία, Νορβηγία, Σουηδία, (β)μεταξύ 20% και 50% του εργατικού δυναμικού είναι εγγεγραμμένοι σε συνδικάτα στην Μ. Βρετανία, Ιταλία, Αυστρία, Ελλάδα, Ισραήλ, Λουξεμβούργο, ενώ (γ)επίπεδα συνδικαλισμού κάτω από 20% βρίσκουμε στις ΗΠΑ, Γαλλία, Τουρκία, Μεξικό, Ιαπωνία, Κορέα και Ισπανία.

Καθώς τα σχήματα διανομής κερδών είναι ήδη ευρύτατα διαδεδομένα σε όλο το κόσμο, είναι λογικό να αναρωτηθεί κανείς γιατί οι επιχειρήσεις επιλέγουν τέτοια σχήματα και πώς η δομή του συνδικάτου και το επίπεδο του συνδικαλισμού επηρεάζουν αυτήν την απόφαση της επιχείρησης. Επιπλέον, είναι λογικό να αναρωτηθεί κανείς το πώς μπορεί να επηρεάσει αυτήν την απόφαση της επιχείρησης η δομή της αγοράς προϊόντος και αν, τελικά, αυτά τα σχήματα έχουν να προσφέρουν κάτι στη βελτίωση της κοινωνικής ευμάρειας. Για να απαντήσουμε σε αυτά τα ερωτήματα, θεωρούμε ένα παίγνιο (με την παιγνιοθεωρητική έννοια του όρου) μεταξύ δυο επιχειρήσεων που ανταγωνίζονται ολιγοπωλιακά στην αγορά προϊόντος επί ενός οριζόντια διαφοροποιημένου προϊόντος, ενώ μεγιστοποιούν τα κέρδη τους επιλέγοντας ποσότητες, και τα αντίστοιχα δυο επιχειρησιακά συνδικάτα τους, τα οποία είναι οι μοναδικοί προμηθευτές εργασίας των επιχειρήσεων. Οι επιχειρήσεις αντιμετωπίζουν μια ζήτηση προϊόντος από τους καταναλωτές που μοντελοποιείται κατά Singh and Vives (1984) μέσω μιας τετραγωνικής και αυστηρά κοίλης συνάρτησης χρησιμότητας, η οποία παράγει μια γραμμική ζήτηση. Θεωρούμε τεχνολογία παραγωγής κατά Leontief και σταθερό οριακό κόστος, που χωρίς βλάβη της γενικότητας έχει τεθεί ίσο με το μηδέν. Οι επιχειρήσεις θεωρούνται εκ των προτέρων συμμετρικές με πλήρη και τέλεια πληροφόρηση. Το παίγνιο εξελίσσεται στα ακόλουθα χρονικά στάδια.

Στάδιο 0: Κατ' αρχήν, θεωρούμε τα συνδικάτα ως επιχειρησιακά. Σε αυτό το αρχικό στάδιο, τα συνδικάτα αποφασίζουν το αν θα συντονιστούν και θα σχηματίσουν ένα κλαδικό συνδικάτο, ή αν θα παραμείνουν επιχειρησιακά και επομένως διαπραγματευτούν σε αποκεντρωμένο επίπεδο. Θεωρούμε ότι τα ηγετικά μέλη των συνδικάτων επιδιώκουν την μεγιστοποίηση των οικονομικών προσόδων που αποκομίζει το σύνολο των μελών του συνδικάτου από την εργασία του (Oswald, 1982). Μαθηματικώς, θεωρούμε ότι τα ηγετικά μέλη των συνδικάτων μεγιστοποιούν μια συνάρτηση χρησιμότητας του τύπου Stone-Geary.

Στάδιο 1: Σε αυτό το στάδιο, οι επιχειρήσεις αποφασίζουν το αν θα παρέχουν κάποιο σχήμα διανομής κερδών στους εργαζόμενους τους ή όχι. Στην πρώτη περίπτωση, ο κάθε εργαζόμενος, πλέον του σταθερού μισθού ανεξαρτήτως παραγωγικότητας θα λαμβάνει και ένα ποσοστό από τα κέρδη της επιχείρησης. Στην δεύτερη περίπτωση, αυτό το ποσοστό είναι ίσο με το μηδέν. Η επιχείρηση ανακοινώνει την απόφασή της βάσει του υποδείγματος "αποδέξου ή απέρριψε", χωρίς να το διαπραγματεύεται επιπλέον.

Στάδιο 2: Πρόκειται για το στάδιο διαπραγμάτευσης. Το υποδειγματοποιούμε κάνοντας χρήση του ασύμμετρου γενικευμένου γινομένου διαπραγμάτευσης κατά Nash. Σε αυτό το στάδιο έχουμε έξι πιθανές καταστάσεις (υποπαίγνια):

(α1)αποκεντρωμένο καθολικό σχήμα διανομής κερδών, όπου τα επιχειρησιακά συνδικάτα αποφάσισαν στο στάδιο 0 να παραμείνουν ξεχωριστά, ενώ και οι δυο επιχειρήσεις αποφάσισαν στο στάδιο 1 να δώσουν σχήμα διανομής κερδών,

(α2)αποκεντρωμένο καθολικό σταθερό μισθό, όπου τα επιχειρησιακά συνδικάτα αποφάσισαν στο στάδιο 0 να παραμείνουν ξεχωριστά, ενώ και οι δυο επιχειρήσεις αποφάσισαν στο στάδιο 1 να δώσουν μόνον μισθό,

(α3)αποκεντρωμένο μικτό σχήμα, όπου τα επιχειρησιακά συνδικάτα αποφάσισαν στο στάδιο 0 να παραμείνουν ξεχωριστά, ενώ, χωρίς βλάβη της γενικότητας, η πρώτη επιχείρηση αποφάσισε να δώσει σχήμα διανομής κερδών ενώ η δεύτερη αποφάσισε να δώσει μόνον σταθερό μισθό,

(β1)κλαδικό καθολικό σχήμα διανομής κερδών, όπου τα επιχειρησιακά συνδικάτα αποφάσισαν στο στάδιο 0 να ενωθούν και να σχηματίσουν ένα κλαδικό συνδικάτο, ενώ και οι δυο επιχειρήσεις αποφάσισαν στο στάδιο 1 να δώσουν σχήμα διανομής κερδών,

(β2)κλαδικό καθολικό σταθερό μισθό, όπου τα επιχειρησιακά συνδικάτα αποφάσισαν στο στάδιο 0 να ενωθούν και να σχηματίσουν ένα κλαδικό συνδικάτο, ενώ και οι δυο επιχειρήσεις αποφάσισαν στο στάδιο 1 να δώσουν μόνον μισθό,

(β3)κλαδικό μικτό σχήμα, όπου τα επιχειρησιακά συνδικάτα αποφάσισαν στο στάδιο 0 να ενωθούν και να σχηματίσουν ένα κλαδικό συνδικάτο ενώ, χωρίς βλάβη της γενικότητας, η πρώτη επιχείρηση αποφάσισε να δώσει σχήμα διανομής κερδών ενώ η δεύτερη αποφάσισε να δώσει μόνον σταθερό μισθό.

Στάδιο 3: στάδιο ολιγοπωλιακού ανταγωνισμού. Οι δυο επιχειρήσεις ανταγωνίζονται στην αγορά προϊόντος επιλέγοντας ποσότητες. Έχοντας επιλέξει μια τεχνολογία παραγωγής τύπου Leontief, η παραγόμενη ποσότητα είναι ανάλογη της εργατικής απασχόλησης, επομένως σε αυτό το στάδιο οι επιχειρήσεις, συν τοις άλλοις, επιλέγουν και το πόσα άτομα του συνδικάτου θα απασχολήσουν εργασιακά. Για αυτή την υποδειγματοποίηση χρησιμοποιήσαμε το υπόδειγμα του "δικαιώματος στην διοίκηση" κατά το οποίο η επιχείρηση δεν διαπραγματεύεται το πόσους εργαζόμενους θα προσλάβει. Για την επίλυση αυτού του παιγνίου χρησιμοποιήσαμε την μέθοδο επίλυσης Nash–in–Nash (Rey and Verge, 2017). Επίσης, κατά τον Horn and Wolinsky (1988), θεωρούμε ότι η διαπραγμάτευση μεταξύ επιχείρησης και συνδικάτου δεν εξαρτάται από το αν έχει επιτευχθεί ή όχι συμφωνία μεταξύ του άλλου ζεύγους επιχείρησης–συνδικάτου (για περισσότερη ανάλυση είδε Milliou and Petrakis (2007)).

Λύνοντας το παίγνιο μέσω των γνωστών μεθόδων οπισθογενούς επαγωγής και συνθηκών Α' τάξης, καταλήγουμε στις ποσότητες ισορροπίας, οι οποίες εξαρτώνται μόνον από τις εξωγενώς ορισμένες παραμέτρους του προβλήματος. Τα βασικά ευρήματα αυτής της έρευνας είναι τα εξής.

(1)Είναι πάντα βέλτιστο για τα συνδικάτα να οργανωθούν σε ένα κλαδικό συνδικάτο, καθώς έτσι μπορούν να αυξήσουν την διαπραγματευτική τους ισχύ και να προσπορίσουν υψηλότερες προσόδους από τις επιχειρήσεις.

(2)Οι συντονισμένες διαπραγματεύσεις ενισχύουν την ύπαρξη σχημάτων διανομής κερδών, ενώ υπό προϋποθέσεις είναι πιθανή ακόμη και η ύπαρξη μικτών καταστάσεων, μετατρέποντας τις εκ των προτέρων συμμετρικές επιχειρήσεις σε εκ των υστέρων ασύμμετρες.

(3)Όσο αυξάνεται η οριζόντια διαφοροποίηση των προϊόντων, τόσο πιο πιθανό γίνεται οι επιχειρήσεις να προσφέρουν ένα σχήμα διανομής κερδών, ανεξαρτήτως από την διαπραγματευτική τους ισχύ.

(4)Αν οι επιχειρήσεις αποφασίσουν να μεγιστοποιήσουν κέρδη επιλέγοντας τιμές (και όχι ποσότητες) τότε δεν υπάρχει περίπτωση να επιλέξουν ποτέ ένα σχήμα διανομής κερδών, ενώ ακόμη και σε αυτή τη περίπτωση ανταγωνισμού τα συνδικάτα θα επιλέξουν να συντονιστούν σε ένα κλαδικό συνδικάτο.

(5)Τέλος, η συνολική απασχόληση, το πλεόνασμα καταναλωτή και η συνολική κοινωνική ευμάρεια είναι πάντα υψηλότερες κάτω από αποκεντρωμένες διαπραγματεύσεις (επιχειρησιακά συνδικάτα) και χρήση σχημάτων διανομής κερδών.

Αυτά τα θεωρητικά αποτελέσματα συμφωνούν με τις εμπειρικές μελέτες επί των σχημάτων διανομής κερδών (ενδεικτικά είδε Sesil et al. (2002), Kraft and Ugarkovic (2005), Kruse (1992) και άλλες). Τα θεωρητικά αποτελέσματα αυτά μπορούν να βρουν εφαρμογή σε μια σειρά θεμάτων άσκησης πολιτικής, όπως στο ότι οι ασκούντες πολιτική θα πρέπει να ενθαρρύνουν τη χρήση σχημάτων διανομής κερδών και την αποκεντρωμένη διαπραγμάτευση. Επίσης, αυτή η θεωρητική μελέτη μπορεί να επεκταθεί και σε αντίστοιχα εμπειρικά πεδία, ερευνώντας με χρήση δεδομένων το πώς η δομή των συνδικάτων και το επίπεδο συνδικαλισμού επηρεάζουν την χρήση σχημάτων διανομής κερδών από τις επιχειρήσεις. ■

Κεφαλαιο 2. Το Καθεστως Δημοσιοποιησης και οι Διαπραγματευσεις των Συμβολαιων σε Καθετες Αγορες

Τα κάθετα συμβόλαια, στα οποία τουλάχιστον ένα από τα αντισυμβαλλόμενα μέρη διαθέτει αυξημένα μερίδια αγοράς, μπορούν να οδηγήσουν σε καταστάσεις μείωσης ανταγωνισμού στην αγορά προϊόντος (Office of Fair Trading, 2004). Η διαδικασία συμβολαιοποίησης μεταξύ δυο κάθετα συνδεδεμένων επιχειρήσεων (π.χ. προμηθευτής – πελάτης) δεν περιορίζεται μόνον στους νομικούς και οικονομικούς όρους των συμβολαίων καθαυτών, αλλά τουλάχιστον επεκτείνεται και στο καθεστώς δημοσιοποίησης των όρων αυτών των συμβολαίων. Οι διάφοροι όροι που περιέχονται στα κάθετα συμβόλαια, και συνολικά αναφέρονται στη βιβλιογραφία με τον όρο "κάθετοι περιορισμοί", μπορούν να προκαλέσουν τόσο θετικά όσο και αρνητικά αποτελέσματα στον ανταγωνισμό στην αγορά προϊόντος (Rey, 2012). Για αυτόν τον λόγο τραβούν το ενδιαφέρον τόσο των ερευνητών όσο και των ρυθμιστικών αρχών σε παγκόσμιο επίπεδο (European Commission, 2010). Κάποιος μπορεί ενδεχομένως να αναρωτηθεί: πώς μπορεί το καθεστώς δημοσιοποίησης των όρων των κάθετων συμβολαίων να επηρεάσει τον ανταγωνισμό και την κοινωνική ευημερία. Η σύντομη απάντηση είναι το ότι όπως θα δείξουμε αναλυτικά παρακάτω, σε μια κάθετη αγορά δυο βαθμίδων, η ανάντη επιχείρηση (π.χ. ο προμηθευτής/χονδρέμπορος) μπορεί να χρησιμοποιήσει την δημοσιοποίηση (ή μη) των όρων ενός κάθετου συμβολαίου με την κατάντη επιχείρηση (π.χ. ο λιανέμπορος) για να χειραγωγήσει τον ανταγωνισμό της αγοράς προϊόντος κατά τα συμφέροντά του. Αυτή η έρευνα συνδέεται με έναν ευρύτερο διάλογο στο επιστημονικό πεδίο της Βιομηχανικής Οργάνωσης στο κατά πόσον είναι εφικτό μια κατάντη επιχείρηση να γνωρίζει με ακρίβεια και σιγουριά τους όρους του κάθετου συμβολαίου μιας άλλης κατάντης επιχείρησης με έναν κοινό (ή όχι) προμηθευτή. Μια μερίδα των ερευνητών θεωρούν αδύνατη την πλήρη δημοσιοποίηση των όρων, και ως εκ τούτου θεωρούν ότι κάθε κάθετο συμβόλαιο θα πρέπει να αντιμετωπίζεται ως "μη-παρατηρήσιμο" ή αλλιώς "μυστικό" από τους ανταγωνιστές (είδε χαρακτηριστικά τους εξής: (Katz, 1991; O'Brien and Shaffer, 1992; McAfee and Schwartz, 1994, 1995; Rey and Verge, 2004; Rey and Tirole, 2006; Arya and Mittendorf, 2011)). Από την άλλη πλευρά, μια αντίστοιχη μερίδα των ερευνητών θεωρούν ότι δεν υπάρχει λόγος να κάνουμε μια τέτοια υπόθεση, καθώς με την ταχύτητα και τον πλούτο της πληροφόρησης στον επιχειρηματικό κόσμο στις μέρες μας, δεν είναι δυνατόν να παραμείνει κρυφό το οτιδήποτε (είδε χαρακτηριστικά τους εξής: (Rey and Stiglitz, 1988; Katz, 1988; Horn and Wolinsky, 1988; Chen, 2001; de Fontenay and Gans, 2005; Milliou and Petrakis, 2007; Marx and Shaffer, 2007)). Βάσει αυτών, λοιπόν, κάθε κάθετο (ή μη) συμβόλαιο είναι "παρατηρήσιμο". Σε κάθε μια από τις δυο περιπτώσεις, οι ερευνητές αντιμετωπίζουν αυτή την απόφαση ως εξωγενώς προσδιορισμένη και επιβεβλημένη σε όλους τους συμμετέχοντες.

Προσπαθώντας, μέσα από αυτό το Κεφάλαιο, να λύσουμε αυτή τη διχογνωμία της ερευνητικής κοινότητας, έχουμε να προτείνουμε την ενδογενοποίηση αυτής της απόφασης, βάσει του ακόλουθου σκεπτικού. Στα πλαίσια ενός συμβολαίου, οι αντισυμβαλλόμενοι μπορούν πριν τη υπογραφή του συμβολαίου καθαυτού, να υπογράψουν μια συμφωνία μη–αποκάλυψης των όρων του συμβολαίου που θα προκύψει μετά την όποια διαπραγμάτευση. Στην πλειονότητα των δικαστηρίων της Ευρώπης, Ασίας και Λατινικής Αμερικής (εξαιρούμε, λοιπόν, χώρες που δανείζονται νομικά στοιχεία από το Βρετανικό Δίκαιο όπως π.χ. ΗΠΑ, Μ. Βρετανία, Καναδάς, Αυστραλία) αυτή η συμφωνία θεωρείται ως μιας μορφής προ–συμβολαιακή διευθέτηση, και ως τέτοια λογίζεται ως αναπόσπαστο μέρος των συμβολαίων. Ως εκ τούτου, τυχόν παραβίαση αυτής της προ–συμβολαιακής διευθέτησης μπορεί να επιφέρει ρήτρες ή ακόμη και ακύρωση του επακόλουθου συμβολαίου (Schwartz and Scott, 2007). Για να είναι μη–παρατηρήσιμοι (μυστικοί) οι όροι ενός κάθετου συμβολαίου είναι υποχρεωτικό να δεχθούν να υπογράψουν τη συμφωνία μη–αποκάλυψης και οι δυο αντισυμβαλλόμενοι (ανάντη και κατάντη επιχείρηση). Σε περίπτωση που ένας από τους δυο αρνηθεί να υπογράψει τη συμφωνία μη–αποκάλυψης, τότε θεωρούμε ότι οι όροι του κάθετου συμβολαίου είναι παρατηρήσιμοι. Το αν θα υπογράψει μια επιχείρηση τους όρους του συμβολαίου ή όχι σχετίζεται αποκλειστικά με την μεγιστοποίηση των κερδών της. Τα ερευνητικά ερωτήματα, λοιπόν, που καλούμαστε να απαντήσουμε σε αυτό το Κεφάλαιο είναι τα εξής: ποια θα είναι η ενδογενής απόφαση των αντισυμβαλλόμενων ως προς τη δημοσιοποίηση των όρων του κάθετου συμβολαίου; Θα δεχθούν και οι δυο να υπογράψουν μια συμφωνία μη–αποκάλυψης ή μήπως όχι; Ποια έκβαση, τελικά, είναι προς το κοινωνικό συμφέρον και πώς πρέπει να αντιδράσει η εκάστοτε ρυθμιστική αρχή;

Σε κάθε περίπτωση, δεν θα πρέπει να υποτιμήσουμε τόσο την φύση των ανάντη προμηθευτών όσο και την δομή των κάθετων συμβολαίων. Ένας ανάντη μονοπωλητής αντιμετωπίζει τον ανταγωνισμό στην αγορά προϊόντος σαν "εσωτερικό" ανταγωνισμό μεταξύ δυο κατάντη διανομέων του. Έτσι, είναι προς το συμφέρον του να χρησιμοποιήσει τα κάθετα συμβόλαια με τέτοιο τρόπο ούτως ώστε να μεγιστοποιήσει τα κέρδη του μέσα από μια άμβλυνση του ανταγωνισμού στην αγορά προϊόντος. Αυτό μπορεί ενδεχομένως να οδηγήσει σε μείωση του πλεονάσματος καταναλωτή, μείωση των διαθέσιμων ποσοτήτων καθώς και αύξηση των λιανικών τιμών. Από την άλλη πλευρά, δυο ξεχωριστοί αφοσιωμένοι και αποκλειστικοί ανάντη προμηθευτές αντιμετωπίζουν τον ανταγωνισμό στην αγορά προϊόντος σαν "εξωτερικό" ανταγωνισμό. Είναι, λοιπόν, προς το συμφέρον τους να οξύνουν τον ανταγωνισμό στην αγορά προϊόντος, οδηγώντας ενδεχομένως σε αύξηση της διαθέσιμης ποσότητας, μείωσης των λιανικών τιμών καθώς και αύξηση του πλεονάσματος καταναλωτή (Milliou and Petrakis, 2007). Ταυτόχρονα, η επιλογή της δομής του κάθετου συμβολαίου παίζει σημαίνοντα ρόλο στο μοίρασμα των κερδών σε μια κάθετη αλυσίδα ανάντη–κατάντη επιχειρήσεων. Μη–γραμμικά κάθετα συμβόλαια, όπως τα συμβόλαια με ταρίφες δυο μερών, μπορούν να ενισχύσουν τον συντονισμό ανάντη και κατάντη επιχείρησης και να οδηγήσουν σε μεγιστοποίηση των από κοινού κερδών της κάθετης αλυσίδας, εν αντιθέσει με τα γραμμικά συμβόλαια στα οποία ελλοχεύει πάντα ο κίνδυνος του διμερούς θετικού περιθωρίου κέρδους (Rey, 2012).

Για να απαντήσουμε σε αυτά τα ερευνητικά ερωτήματα, θεωρούμε ένα παίγνιο (με την παιγνιοθεωρητική έννοια του όρου) μεταξύ δυο κατάντη επιχειρήσεων που ανταγωνίζονται ολιγοπωλιακά στην αγορά προϊόντος επί ενός οριζόντια διαφοροποιημένου προϊόντος, ενώ μεγιστοποιούν τα κέρδη τους επιλέγοντας ποσότητες, και τους αντίστοιχους δυο αποκλειστικά αφοσιωμένους ανάντη προμηθευτές τους, με τους οποίους υπάρχει μια σχέση "1-1" υπό την έννοια ότι κάθε μονάδα που προμηθεύει η ανάντη την κατάντη επιχείρηση μετασχηματίζεται σε μια μονάδα τελικού προϊόντος. Οι επιχειρήσεις αντιμετωπίζουν μια ζήτηση προϊόντος από τους καταναλωτές που μοντελοποιείται κατά Singh and Vives (1984) μέσω μιας τετραγωνικής και αυστηρά κοίλης συνάρτησης χρησιμότητας, η οποία παράγει μια γραμμική ζήτηση. Θεωρούμε τεχνολογία παραγωγής κατά Leontief και σταθερό οριακό κόστος, που χωρίς βλάβη της γενικότητας έχει τεθεί ίσο με το μηδέν. Οι επιχειρήσεις θεωρούνται εκ των προτέρων συμμετρικές με πλήρη και τέλεια πληροφόρηση. Το παίγνιο εξελίσσεται στα ακόλουθα χρονικά στάδια.

Προ-Στάδιο: Κατ' αρχήν, οι επιχειρήσεις αποφασίζουν το αν θα υπογράψουν τη συμφωνία μη–αποκάλυψης ή όχι. Σε περίπτωση που και οι δυο επιχειρήσεις αποφασίσουν να υπογράψουν αυτή τη συμφωνία, τότε οι όροι του συμβολαίου θεωρούνται ως μη–παρατηρήσιμοι. Σε περίπτωση όπου έστω ένας από τους δυο αποφασίσει να μην υπογράψει, τότε οι όροι θεωρούνται παρατηρήσιμοι. Υπάρχει, βέβαια και η μικτή περίπτωση όπου η μια κάθετη αλυσίδα ανάντη–κατάντη επιχειρήσεων υπογράφει συμφωνία μη–αποκάλυψης ενώ η άλλη κάθετη αλυσίδα δεν υπογράφει.

Στάδιο 1: Πρόκειται για το στάδιο διαπραγμάτευσης μεταξύ ανάντη και κατάντη επιχειρήσεων. Το υποδειγματοποιούμε κάνοντας χρήση του γενικευμένου ασύμμετρου γινομένου διαπραγμάτευσης κατά Nash. Στην περίπτωση όπου η κάθετη αλυσίδα αποφασίσει να υπογράψει μια συμφωνία μη–αποκάλυψης, τότε εφ' όσον η αντίπαλη αλυσίδα δεν παρατηρεί τις ποσότητες ισορροπίας, θα πρέπει κατά τη βέλτιστη αντίδραση κατά Nash να σχηματίσει κάποιου είδους πεποιθήσεις ως προς το αν η αντίπαλη αλυσίδα κατέληξε σε κάποια συμφωνία ή όχι. Οι πεποιθήσεις που χρησιμοποιούνται στην βιβλιογραφία είναι κατά κόρον οι παθητικές πεποιθήσεις, κατά τις οποίες η αλυσίδα που δεν παρατηρεί την έκβαση των διαπραγματεύσεων της αντίπαλης αλυσίδας, θεωρεί ότι αυτή κατέληξε σε κάποιου είδους συμφωνία στην ισορροπία (Rey and Verge, 2004; Milliou and Petrakis, 2007).

Στάδιο 2: Είναι το στάδιο του ολιγοπωλιακού ανταγωνισμού στην αγορά προϊόντος. Οι δυο κατάντη επιχειρήσεις ανταγωνίζονται ολιγοπωλιακά στην αγορά προϊόντος επιλέγοντας ποσότητες. Για την επίλυση αυτού του παιγνίου χρησιμοποιήσαμε την μέθοδο επίλυσης Nash–in–Nash (Rey and Verge, 2017). Επίσης, κατά τον Horn and Wolinsky (1988), θεωρούμε ότι η διαπραγμάτευση μεταξύ επιχείρησης και συνδικάτου δεν εξαρτάται από το αν έχει επιτευχθεί ή όχι συμφωνία μεταξύ του άλλου ζεύγους επιχείρησης–συνδικάτου (για περισσότερη ανάλυση είδε Milliou and Petrakis (2007)).

Λύνοντας το παίγνιο μέσω των γνωστών μεθόδων οπισθογενούς επαγωγής και συνθηκών Α' τάξης, καταλήγουμε στις ποσότητες ισορροπίας, οι οποίες εξαρτώνται μόνον από τις εξωγενώς ορισμένες παραμέτρους του προβλήματος. Τα βασικά ευρήματα αυτής της έρευνας είναι τα εξής.

(1)Υποθέτουμε ανταγωνισμό σε ποσότητες και κάθετα συμβόλαια ταρίφας δυο μερών. Σε περίπτωση ύπαρξης μιας μονοπωλιακής ανάντη επιχείρησης, και τα δυο μέλη της κάθετης αλυσίδας είναι αδιάφορα μεταξύ του να υπογράψουν ή όχι τη συμφωνία μη–αποκάλυψης. Αν διατάξουμε αυτά τα δυο σημεία ισορροπίας κατά Pareto, τότε επικρατεί η αποκάλυψη των όρων του κάθετου συμβολαίου.

(2)Η κοινωνική ευημερία είναι βέλτιστη κάτω από πλήρη αποκάλυψη, και ελάχιστη κάτω από πλήρη μυστικότητα των όρων του κάθετου συμβολαίου.

(3)Αν οι κατάντη επιχειρήσεις ανταγωνίζονται σε τιμές (ceteris paribus), τότε είναι μοναδική ισορροπία η αποκάλυψη των όρων του κάθετου συμβολαίου.

(4)Σε περίπτωση χρήσης γραμμικών συμβολαίων (ceteris paribus), τότε είναι μοναδική ισορροπία η αποκάλυψη των όρων του κάθετου συμβολαίου.

(5)Σε περίπτωση δυο αφοσιωμένων αποκλειστικών ανάντη προμηθευτών (ceteris paribus), τότε είναι μοναδική ισορροπία η μη–αποκάλυψη των όρων του κάθετου συμβολαίου.

(6)Στην περίπτωση ανταγωνισμού σε ποσότητες και με χρήση μη–γραμμικών συμβολαίων ταρίφας δυο μερών, τότε οι δυο ανάντη επιχειρήσεις δεν έχουν κίνητρο να συγχωνευτούν.

Αυτά τα θεωρητικά αποτελέσματα μπορούν να βοηθήσουν τους ασκούντες πολιτική, ως προς το ποια θα πρέπει να είναι η στάση τους απέναντι στις συμφωνίες μη–αποκάλυψης. Είναι ξεκάθαρο ότι το κοινωνικά βέλτιστο είναι η πλήρης αποκάλυψη όλων των όρων των κάθετων συμβολαίων, καθώς αυτό, σε κάθε περίπτωση, αυξάνει την συνολική διαθέσιμη ποσότητα προϊόντος στην αγορά, μειώνει τις λιανικές τιμές και αυξάνει την κοινωνική ευημερία. Τέλος, η θεωρητική αυτή μελέτη μπορεί να επεκταθεί και σε εμπειρικά πεδία, χρησιμοποιώντας δεδομένα τιμών και ποσοτήτων από αγορές με συχνή χρήση συμφωνιών μη–αποκάλυψης και σύγκριση αυτών των αποτελεσμάτων ε αντίστοιχες αγορές με σπάνια χρήση συμφωνιών μη–αποκάλυψης. ■

Κεφαλαιο 3. Καθετες Συμφωνιες και Συγχωνευσεις στην Ανάντη Αγορα

Μια σειρά από πρόσφατες συγχωνεύσεις και εξαγορές, έχουν προβληματίσει τις ρυθμιστικές αρχές και στις δυο πλευρές του Ατλαντικού. Η αμερικάνικη επιχείρηση ταχυμεταφορών UPS πρότεινε το 2013 στην ολλανδική TNT την εξαγορά της έναντι \$7 δισεκατομμυρίων. Η ευρωπαϊκή ρυθμιστική αρχή απέτρεψε αυτή τη συμφωνία με την αιτιολογία του ότι θα μειώσει τον ανταγωνισμό στην αγορά και θα μειώσει και τις επιλογές των καταναλωτών. Όμως, λίγα χρόνια αργότερα, το 2016, ήταν η ίδια ρυθμιστική αρχή που επέτρεψε την εξαγορά της TNT από την επίσης αμερικάνικη FedEx έναντι μικρότερου τιμήματος \$5 δισεκατομμυρίων. Στην άλλη πλευρά του Ατλαντικού, η αμερικάνικη ρυθμιστική αρχή ανταγωνισμού απέρριψε το 2001 μια συγχώνευση μεταξύ των αεροπορικών εταιρειών US Airways και United Airlines με το σκεπτικό ότι μια τέτοια συμφωνία θα αυξήσει τις τιμές των αεροπορικών εισιτηρίων, όμως επέτρεψε το 2013 την συγχώνευση μεταξύ της τελευταίας και της American Airlines. Υπάρχουν δεκάδες περιπτώσεις εξαγορών και συγχωνεύσεων στις οποίες οι ρυθμιστικές αρχές άσκησαν βέτο και τις ακύρωσαν στην πράξη (όπως π.χ. τη συγχώνευση των τηλεπικοινωνιακών κολοσσών AT&T και T−Mobile), αλλά και άλλες στις οποίες οι ρυθμιστικές αρχές δεν έδειξαν κάποια ιδιαίτερη σπουδή (όπως π.χ. μεταξύ των γιγάντων της χημικής βιομηχανίας DuPont και Dow Chemicals).

Ένα ιδιαίτερο χαρακτηριστικό όλων αυτών των επιχειρήσεων είναι το ότι δεν συναλλάσσονται μόνον με τους τελικούς καταναλωτές, αλλά λειτουργούν επίσης και ως ανάντη προμηθευτές άλλων κατάντη επιχειρήσεων. Επειδή, ίσως δεν είναι ξεκάθαρο, ας παραθέσουμε ένα απλό παράδειγμα: οι επιχειρήσεις ταχυμεταφορών χρησιμοποιούν συχνά κάποιες μικρές τοπικές επιχειρήσεις για να κάνουν την τελική διανομή από το τοπικό hub της επιχείρησης (που μπορεί να είναι ακόμη και σε άλλη πόλη) έως το τελικό σημείο παράδοσης. Ένα σημαντικό στοιχείο, επίσης είναι και η δομή των συμβολαίων που χρησιμοποιούνται στην εκάστοτε αγορά. Στον επιχειρηματικό κόσμο χρησιμοποιείται μια πληθώρα διαφορετικών συμβολαίων. Η επιλογή σχετίζεται με τις ανάγκες της κάθε αγοράς να παρακάμψει ή και να θεραπεύσει ενδογενή προβλήματα όπως κόστη παρακολούθησης εργασιών και προόδου, το πρόβλημα της κράτυνσης, το πρόβλημα της αφοσίωσης, ασυμμετρίες στην πληροφόρηση και τόσα άλλα. Συνδυασμός αυτών μπορεί να οδηγήσει ακόμη και σε κατάρρευση της αγοράς. Έτσι λοιπόν, αφού έχει ήδη μελετηθεί η ισορροπία στην χρήση γραμμικών συμβολαίων και συμβολαίων ταρίφας δυο μερών (Milliou and Petrakis, 2007), αλλά και η χρήση γραμμικών συμβολαίων και συμφωνιών κάθετης συνιδιοκτησίας (Sorensen, 1992), είναι λογικό κάποιος να θελήσει να καλύψει το κενό που υπάρχει στη βιβλιογραφία στην ισορροπία της χρήσης συμβολαίων ταρίφας δυο μερών και συμφωνιών κάθετης συνιδιοκτησίας.

Η παρούσα επιστημονική έρευνα εφάπτεται του επιστημονικού πεδίου της Βιομηχανικής Οργάνωσης, και πιο συγκεκριμένα των επιστημονικών υποπεδίων των κάθετων αγορών και των συγχωνεύσεων. Ένα επιστημονικό άρθρο κοντά στην έρευνά μας είναι αυτό των Milliou and Petrakis (2007). Οι ερευνητές του άρθρου καταλήγουν στο ότι όταν οι κάθετες αλυσίδες χρησιμοποιούν γραμμικά συμβόλαια και τα προϊόντα είναι αρκούντως υποκατάστατα, οι ανάντη επιχειρήσεις έχουν πάντα κίνητρο να συγχωνευτούν Από την άλλη, η χρήση συμβολαίων ταρίφας δύο μερών δεν αφήνει περιθώρια συγχωνεύσεων στην ανάντη αγορά. Επίσης, ένα άρθρο που μας επηρέασε κατά την μοντελοποίηση είναι αυτό των Alipranti et al. (2014) στο οποίο επιχειρείται μια σύγκριση του ανταγωνισμού σε ποσότητες με τον ανταγωνισμό σε τιμές. Οι ερευνητές κατέληξαν στο ότι ο δεύτερος μπορεί υπό προϋποθέσεις να είναι πιο ανταγωνιστικός από τον πρώτο, εν αντιθέσει με τα ευρήματα της σχετικής βιβλιογραφίας.

Για να απαντήσουμε σε αυτά τα ερευνητικά ερωτήματα, θεωρούμε ένα παίγνιο (με την παιγνιοθεωρητική έννοια του όρου) μεταξύ δυο κατάντη επιχειρήσεων που ανταγωνίζονται ολιγοπωλιακά στην αγορά προϊόντος επί ενός οριζόντια διαφοροποιημένου προϊόντος, ενώ μεγιστοποιούν τα κέρδη τους επιλέγοντας ποσότητες. Θεωρούμε, επίσης και τους αντίστοιχους δυο αποκλειστικά αφοσιωμένους ανάντη προμηθευτές τους, με τους οποίους υπάρχει μια σχέση "1-1" υπό την έννοια ότι κάθε μονάδα που προμηθεύει η ανάντη την κατάντη επιχείρηση μετασχηματίζεται σε μια μονάδα τελικού προϊόντος. Οι επιχειρήσεις αντιμετωπίζουν μια ζήτηση προϊόντος από τους καταναλωτές που μοντελοποιείται κατά Singh and Vives (1984) μέσω μιας τετραγωνικής και αυστηρά κοίλης συνάρτησης χρησιμότητας, η οποία παράγει μια γραμμική ζήτηση. Θεωρούμε τεχνολογία παραγωγής κατά Leontief και σταθερό οριακό κόστος, που χωρίς βλάβη της γενικότητας έχει τεθεί ίσο με το μηδέν. Οι επιχειρήσεις θεωρούνται εκ των προτέρων συμμετρικές με πλήρη και τέλεια πληροφόρηση. Το παίγνιο εξελίσσεται στα ακόλουθα χρονικά στάδια.

Στάδιο 1: Κατ' αρχήν θεωρούμε ότι οι δυο ανάντη προμηθευτές είναι δυο ανεξάρτητες ανταγωνιστικές επιχειρήσεις. Σε αυτό το στάδιο, οι δυο ανάντη επιχειρήσεις επιλέγουν το αν θα συγχωνευτούν ή όχι. Αν αποφασίσουν να συγχωνευτούν, τότε θα σχηματίσουν έναν ανάντη μονοπωλητή, που θα προμηθεύει ταυτόχρονα και τις δυο κατάντη επιχειρήσεις.

Στάδιο 2: Αναλόγως την έκβαση του προηγούμενου σταδίου, είτε οι δυο ανάντη αποκλειστικές επιχειρήσεις είτε ο ανάντη μονοπωλητής, αποφασίζουν για τον τύπο του συμβολαίου που θα προσφέρουν στις κατάντη επιχειρήσεις. Έχουν να επιλέξουν μεταξύ συμβολαίων ταρίφας δυο μερών και συμφωνιών κάθετης συνιδιοκτησίας. Εδώ θα πρέπει να ξεχωρίσουμε τα ακόλουθα 6 υποπαίγνια.

(α1)Αποκλειστικές ανάντη με καθολικά συμβόλαια ταρίφας δυο μερών. Στο στάδιο 1 οι ανάντη επιχειρήσεις αποφάσισαν να παραμείνουν ξεχωριστές. Στο στάδιο 2 αποφάσισαν να δώσουν και οι δυο τους συμβόλαια ταρίφας δυο μερών στις αντίστοιχες κατάντη επιχειρήσεις.

(α2)Αποκλειστικές ανάντη με καθολική συμφωνία κάθετης συνιδιοκτησίας. Στο στάδιο 1 οι ανάντη επιχειρήσεις αποφάσισαν να παραμείνουν ξεχωριστές. Στο στάδιο 2 αποφάσισαν να δώσουν και οι δυο τους στις αντίστοιχες κατάντη επιχειρήσεις συμφωνίες κάθετης συνιδιοκτησίας.

(α3)Αποκλειστικές ανάντη με μικτά συμβόλαια. Στο στάδιο 1 οι ανάντη επιχειρήσεις αποφάσισαν να παραμείνουν ξεχωριστές. Στο στάδιο 2 αποφάσισαν, χωρίς βλάβη της γενικότητας, η μεν πρώτη ανάντη να δώσει συμβόλαιο ταρίφας δυο μερών ενώ η δεύτερη ανάντη να δώσει συμφωνία κάθετης συνιδιοκτησίας.

(β1)Ανάντη μονοπωλητής με καθολικά συμβόλαια ταρίφας δυο μερών. Στο στάδιο 1 οι ανάντη επιχειρήσεις αποφάσισαν να συγχωνευτούν. Στο στάδιο 2 ο ανάντη μονοπωλητής αποφάσισε να δώσει και στις δυο κατάντη επιχειρήσεις συμβόλαια ταρίφας δυο μερών.

(β2)Ανάντη μονοπωλητής με καθολική συμφωνία κάθετης συνιδιοκτησίας. Στο στάδιο 1 οι ανάντη επιχειρήσεις αποφάσισαν να συγχωνευτούν. Στο στάδιο 2 ο ανάντη μονοπωλητής αποφάσισε να δώσει και στις δυο κατάντη επιχειρήσεις συμφωνίες κάθετης συνιδιοκτησίας.

(β3)Ανάντη μονοπωλητής με μικτά συμβόλαια. Στο στάδιο 1 οι ανάντη επιχειρήσεις αποφάσισαν να συγχωνευτούν. Στο στάδιο 2 αποφάσισαν, χωρίς βλάβη της γενικότητας, ο ανάντη μονοπωλητής αποφάσισε να προσφέρει στη μεν πρώτη κατάντη συμβόλαιο ταρίφας δυο μερών, στη δε δεύτερη κατάντη συμφωνία κάθετης συνιδιοκτησίας.

Στάδιο 3: Πρόκειται για το στάδιο διαπραγμάτευσης μεταξύ ανάντη και κατάντη επιχειρήσεων. Το υποδειγματοποιούμε κάνοντας χρήση του γενικευμένου ασύμμετρου γινομένου διαπραγμάτευσης κατά Nash (Milliou and Petrakis, 2007).

Στάδιο 4: Είναι το στάδιο του ολιγοπωλιακού ανταγωνισμού στην αγορά προϊόντος. Οι δυο κατάντη επιχειρήσεις ανταγωνίζονται ολιγοπωλιακά στην αγορά προϊόντος επιλέγοντας ποσότητες. Για την επίλυση αυτού του παιγνίου χρησιμοποιήσαμε την μέθοδο επίλυσης Nash–in–Nash (Rey and Verge, 2017). Επίσης, κατά τον Horn and Wolinsky (1988), θεωρούμε ότι η διαπραγμάτευση μεταξύ επιχείρησης και συνδικάτου δεν εξαρτάται από το αν έχει επιτευχθεί ή όχι συμφωνία μεταξύ του άλλου ζεύγους επιχείρησης–συνδικάτου (για περισσότερη ανάλυση είδε Milliou and Petrakis (2007)).

Λύνοντας το παίγνιο μέσω των γνωστών μεθόδων οπισθογενούς επαγωγής και συνθηκών Α' τάξης, καταλήγουμε στις ποσότητες ισορροπίας, οι οποίες εξαρτώνται μόνον από τις εξωγενώς ορισμένες παραμέτρους του προβλήματος. Τα βασικά ευρήματα αυτής της έρευνας είναι τα εξής.

(1)Αν οι ανάντη επιχειρήσεις αποφασίσουν να μην συγχωνευτούν, τότε τόσο το καθεστώς καθολικών συμβολαίων ταρίφας δυο μερών όσο και οι καθολικές συμφωνίες κάθετης συνιδιοκτησίας είναι παιγνιοθεωρητικά ισοδύναμες. Το ίδιο ισχύει και αν αποφασίζουν για το συμβόλαιο οι κατάντη επιχειρήσεις και έχουν αφοσιωμένες αποκλειστικές ανάντη επιχειρήσεις.

(2)Αν οι ανάντη επιχειρήσεις συγχωνευτούν σε έναν ανάντη μονοπωλητή, τότε αυτός θα προτιμήσει τις καθολικές συμφωνίες κάθετης συνιδιοκτησίας. Αν οι κατάντη επιχειρήσεις είναι αυτές που επιλέγουν συμβόλαια και αντιμετωπίζουν έναν ανάντη μονοπωλητή, τότε επιλέγουν καθολικά συμβόλαια ταρίφας δυο μερών.

(3)Συνολικά, οι ανάντη επιχειρήσεις βρίσκουν βέλτιστο το να συγχωνευτούν και να προσφέρουν καθολικές συμφωνίες κάθετης συνιδιοκτησίας. Αν είναι οι κατάντη επιχειρήσεις αυτές που επιλέγουν κάθετα συμβόλαια, τότε θα επιλέξουν καθολικά συμβόλαια ταρίφας δυο μερών και θα οδηγήσουν τις ανάντη επιχειρήσεις στο να μην συγχωνευτούν.

(4)Το κοινωνικά βέλτιστο είναι το καθολικό συμβόλαιο ταρίφας δυο μερών αν οι ανάντη επιχειρήσεις δεν συγχωνευτούν ή η καθολική συμφωνία κάθετης συνιδιοκτησίας στην περίπτωση όπου οι ανάντη επιχειρήσεις συγχωνευτούν. Σε γενικές γραμμές, το κοινωνικά βέλτιστο συμπορεύεται με τα συμφέροντα των κατάντη επιχειρήσεων και αντίθετα από τα συμφέροντα των ανάντη επιχειρήσεων.

(5)Σε περίπτωση ανταγωνισμού σε τιμές στην αγορά προϊόντος, τόσο οι ανάντη όσο και οι κατάντη επιχειρήσεις είναι αδιάφορες μεταξύ των δυο διαθέσιμων συμβολαίων, αν οι ανάντη δεν συγχωνευτούν, ενώ επιλέγουν καθολικά συμβόλαια ταρίφας δυο μερών αν οι ανάντη συγχωνευτούν και η διαφοροποίηση του προϊόντος κινείται σε μέτρια επίπεδα. Αν η τελευταία κινείται σε χαμηλά επίπεδα, επιλέγουν καθολικές συμφωνίες κάθετης συνιδιοκτησίας. Στην περίπτωση υψηλής διαφοροποίησης προϊόντος οι ανάντη επιχειρήσεις υποφέρουν από αρνητικά κέρδη και έτσι δημιουργείται μια παιγνιοθεωρητική ασυνέχεια.

Αυτά τα θεωρητικά αποτελέσματα οδηγούν σε μια σειρά από ελέγξιμες εμπειρικές υποθέσεις με άμεση εφαρμογή στην άσκηση ρυθμιστικής πολιτικής. Κατ' αρχήν σε κλάδους όπου επικρατούν οι αφοσιωμένες και αποκλειστικές ανάντη επιχειρήσεις, αναμένουμε να υπάρχουν οιωνεί ισομερώς μοιρασμένα ποσοστά συμβολαίων ταρίφας δυο μερών και συμβολαίων κάθετης συνιδιοκτησίας. Από την άλλη πλευρά, σε οικονομικούς τομείς με ευρεία ύπαρξη μονοπωλιακών ανάντη επιχειρήσεων, είναι αναμενόμενη η επικράτηση των καθολικών συμφωνιών κάθετης συνιδιοκτησίας. Τέλος, θα είχε ιδιαίτερο ενδιαφέρον να συνδεθεί αυτή η θεωρητική έρευνα με το σχηματισμό δικτύων έρευνας και ανάπτυξης. ■

1

Strategic profit–sharing in a unionized differentiated goods duopoly

1.1 Introduction

Profit–sharing schemes, with one form or another, are in wide use in the real business world.[1] A survey of the largest 1,250 global corporations found that 33% of them offer some sort of a profit-sharing scheme to all employees, while an extra 11% had plans to introduce one (Wee-

[1]A profit-sharing scheme dictates that employees, besides a fixed wage, also receive a share of the firm's profits. In practice, a profit-sharing scheme can take a quite complex form that contains a wide set of different elements (OECD, 1995).

den et al., 1998). Muller (2017) and Lorenzetti (2016) report a few cases of large enterprises offering profit-sharing schemes in the USA in 2015: Ford Motors paid an annual profit share \$9,300 in cash per worker to 56,000 unionized workers, General Motors paid \$11,000 per worker and Fiat Chrysler Automobiles paid \$5,000 per worker to more than 40,000 unionized workers. Moreover, employees of Delta Airlines, Southwest and United Continental Airlines received \$1.5 billion in profit shares the same year. In particular, for Delta Airlines, the profit shares accounted for 21% of the employee's base salary, roughly \$18,000 per employee. American Airlines, the only one of the top four carriers in the USA that didn't offer a profit–sharing scheme, introduced a 5% profit–share ratio to all employees in March 2016 (Carey, 2016). Kato and Morishima (2003) reports that one out of four publicly traded firms in Japan uses a profit–sharing scheme, nearly all profit shares paid annually in cash. Huawei, the largest telecommunications equipment manufacturer in the world, has an extensive profit–sharing scheme: its founder Zheng Fei holds 1.4% of its stocks, while the rest are equally owned by more than 82,000 employees worldwide (De Cremer and Tao, 2015). Blasi et al. (2016) state that group incentive methods of compensation, such as profit–sharing, along with positive internal company policies and culture can help the most profitable firms do even better.

There is a wide variety of unionization structures and unionization levels across countries, or across sectors and within countries.[2] In the USA, UK, Australia, Canada, and Japan, negotiations are decentralized and take place between firm-specific unions and their firms.[3] In contrast, in almost all the euro–area countries plus the Scandinavian countries, negotiations take place either at a sector level or (rarely) at a nation-wide level (Goeddeke, 2010). Yet,

[2]Unionization structure refers to whether workers are organized in firm–specific unions or an industry–wide union (or a nationwide union). In the first case, *decentralized bargaining* over remuneration schemes takes place between each employer and its firm–specific union. In the second case, bargaining over the remuneration scheme(s) can take place either at a centralized level between the representative of all employers and the sector–wide union (*centralized bargaining*) or in a coordinated way between each employer and a representative of the sector–wide union (*coordinated bargaining*) (Haucap and Wey, 2004; Bronfenbrenner and Juravich, 2001). On the other hand, unionization level (or density) refers to the percentage of workers being members of a union which, to a large extent, determines the power of the union during the negotiations.

[3]There are a few exemptions, such as the metalworkers in the USA who are organized in a sector–wide union. In Japan, although negotiations take place at the firm level, there are some important institutions that ensure a high degree of bargaining centralization (Soskice, 1990).

the current trend in the unionization structure in almost all advanced economies worldwide is towards more decentralization (Ellguth et al., 2014). Decentralized bargaining allows for greater flexibility and quicker adjustments, which are vital in globalized economies (Hübler and Meyer, 2000). Regarding the unionization levels, Visser (2006) reports a wide variety across countries. There are countries with unionization levels above 50% (e.g. Iceland, Belgium, Finland, Denmark, Norway, Sweden), and countries with unionization levels below 20% (e.g. France, Korea, USA, Japan, Spain, Turkey, Netherlands, Mexico). Many countries lie in unionization levels between 20% and 50% (e.g. United Kingdom, Canada, Italy, Ireland, Israel, Greece, Austria, Luxembourg). Nonetheless, the last three decades experienced a significant drop in the unionization levels. Pontusson (2013) notes that the deindustrialization and the shift from public to private employment are the two major factors of the de-unionization of the OECD countries, besides various political and institutional factors. It is critical to note that unionized labor could earn, on average, up to 15% higher compensation than the non-unionized (Tracy, 1986).

As profit–sharing schemes are widespread and observed in most of the economies, it is natural to ask why firms offer such remuneration schemes and how the different unionization structures and unionization levels affect their decisions. Further, how the mode and the intensity of competition affect the firms' incentives to offer profit-sharing schemes? Finally, are such remuneration schemes socially desirable?

To address these questions, we consider a differentiated good unionized duopoly, in which firms hire labor exclusively from a worker's union (either firm–specific or sector–wide) and compete in quantities (or prices) in the product market. In stage 0, workers choose whether to form a sector–wide union and coordinate their bargaining efforts (coordinated bargaining, $\mathcal{C}$), or to form two firm-specific unions, each bargaining with its own firm (decentralized bargaining, $\mathcal{D}$). In stage 1, firms decide whether to offer a fixed wage ($\mathcal{FS}$) or a fixed wage plus a profit share ($\mathcal{PS}$). In stage 2, under decentralized bargaining, each firm-specific union and its firm negotiate over the terms of the selected remuneration scheme; while under coordinated bargaining, each firm negotiates with a representative of the sector-wide union over those terms. In the last stage, firms choose their employment levels[4] and set their quantities (or prices) in the product market.

We show that product market characteristics as well as the unionization structure and union power (which may be proxied by the unionization level) affect the firms' incentives to offer profit–sharing schemes. Under Cournot competition, the weaker the union in the bargaining table, the more likely are that firms offer $\mathcal{PS}$,[5] independently whether workers are organized in firm-specific unions or in a sector-wide union. Moreover, the competitive pressure in the market (as measured by the degree of product substitutability) intensifies the firms' incentives to offer $\mathcal{PS}$. Yet, for intermediate levels of union power, firms bargaining with a sector–wide union offer $\mathcal{PS}$, while they offer $\mathcal{FS}$ when they bargain with firm-specific unions. This is because a sector–wide union, in contrast to firm–specific unions, disposes of a positive *outside option*, i.e., in case of disagreement with one firm it can still supply labor to the other firm which becomes a monopolist in the product market. It can thus push for higher wage rate and higher profit share comparing to equally powerful firm-specific unions.

Interestingly, when the products are rather poor substitutes and the sector-wide union's power is neither too high nor too low, ex-ante symmetric firms end up offering different remuneration schemes and producing different quantities in equilibrium. Moreover, there are parameter constellations for which multiple equilibria arise under both decentralized and coordinated bargaining: Both the universal $\mathcal{PS}$ and the universal $\mathcal{FS}$ are equilibrium remuneration scheme configurations, with the latter being a Pareto-superior equilibrium from the firms' point of view (and in which firms are expected to coordinate).

In contrast to Cournot competition, under Bertrand competition, a firm never offers a profit–sharing scheme, independently whether workers are organized in firm-specific unions or in a sector–wide union. Thus, the unique equilibrium remuneration scheme configura-

[4]This is a "right-to-manage" framework. Note that under "efficient bargains"profit–sharing has no effect on the firm's employment level and profitability (Anderson and Devereux (1989))

[5]Note that under $\mathcal{PS}$ a firm-union pair disposes of two instruments and can thus achieve a *bilaterally efficient* outcome during its negotiations. In particular, given any bargained outcome of the rival pair, it chooses the wage rate to maximize joint surplus and uses the profit share ratio to distribute this maximized surplus to the negotiating parties according to their respective bargaining powers.

tion is universal $\mathcal{FS}$. This is because prices are strategic complements and a firm-union bargaining pair has no incentive to agree to a lower wage rate in order to make the firm more aggressive in the product market. The latter could be achieved by the firm offering $\mathcal{PS}$ since a profit-sharing scheme allows a trade-off between wage rates and profit shares. In fact, under Cournot competition, this trade-off is exploited by the firm-union pair and thus the firm has incentives to offer $\mathcal{PS}$ under some circumstances. Notice that the way competitive pressure is proxied in the market is of paramount importance for the likelihood of appearance of profit–sharing schemes. If a competitive pressure increase is proxied by a move from Cournot to Bertrand competition, our findings imply that profit–sharing schemes to be less likely. Yet, if it is measured by an increase in product substitutability, the opposite holds.

Independently of whether firms compete in quantities or prices, in equilibrium the workers are better–off forming a sector–wide union and coordinating their bargaining efforts. This might not be surprising, at least for the case of Bertrand competition, in which firms always offer fixed wage remuneration schemes. Yet, under Cournot competition, although the equilibrium remuneration schemes may differ across unionization structures for the same parameter values, it turns out that coordinated bargaining leads to higher overall rents for the unionized workers. This finding makes the analysis of the coordinated bargaining case to be of great importance and our paper is the first in the literature that has undertaken this task.

Our welfare analysis points out that aggregate employment level and firms' gross profits (i.e., profits before distribution of profit shares) are highest under decentralized bargaining and universal $\mathcal{PS}$. It also reveals that in this case, the highest consumer surplus and social welfare are achieved. This is because firm-specific unions agree on low wages (below their workers outside option) in exchange of high profit–sharing ratios, making their firms more aggressive in the product market, thus increasing employment and output levels. A regulator should then design policy measures to facilitate more flexible bargaining structures and to provide incentives to firms to offer profit–sharing schemes. As mentioned above, there is a recent trend in the developed economies towards more decentralization and, at the same time, there is evidence that unionization levels decline over time. Under these conditions, one should expect that profit–sharing schemes become more prevalent than in the past and that consumers and the society as a whole benefit.

Our paper contributes to the extant literature on the usage of profit–sharing schemes and their market and societal effects. This literature has its origins in the seminal work of Weitzman (Weitzman (1983, 1984, 1985, 1987)), who points out that profit-sharing makes the cost of labour completely flexible and gives firms the incentive to hire as many workers as are willing to take jobs. This leads to a profit-sharing economy with low levels of unemployment and great macroeconomic stability. However, the author assumes away strategic effects by considering monopolistically competitive markets. Bensaid and Gary-Bobo (1991) and Steward (1989) view profit–sharing as a firm's strategic commitment: $\mathcal{PS}$ shifts the market equilibrium outcome in favor of the firm adopting such a remuneration scheme in an oligopolistic environment. According to Steward (1989), a firm's equilibrium profits increase whenever it substitutes fixed wages with an equal part of profit shares (holding the workers' income fixed). Bensaid and Gary-Bobo (1991) show that a firm offering $\mathcal{PS}$ is the best response to both $\mathcal{PS}$ and $\mathcal{FS}$ offered by its rivals, but in equilibrium, all firms are worse–off by adopting profit–sharing schemes.

Similarly to us, a branch of this literature has paid attention to the role of unionization structure for the firms' incentives to offer profit–sharing schemes. In a unionized Cournot duopoly in which firm-specific unions set wages, Fung (1989) shows that the firm with a positive profit share obtains higher market share and profits.[6] Sorensen (1992) considers a unionized homogenous good Cournot duopoly, in which remuneration schemes are negotiated between firms and their firm-specific unions (decentralized bargaining). The author shows that firms offer profit–sharing schemes only if their unions are not too powerful. Goeddeke (2010) extends Sorensen's model to n firms and also considers centralized bargaining in which the sector-wide union negotiates with the employers' federation over a uniform wage rate.

[6] The effect of profit–sharing can be decomposed into two parts. First, a sector-wide effect: $\mathcal{PS}$ causes a wage reduction, which leads to a lower retail price and thus to higher aggregate quantity and employment level. Second, a firm-specific effect: the firm offering a $\mathcal{PS}$ gains a higher market share, and has higher employment and lower wage rate. These beneficial effects give to the firm offering a $\mathcal{PS}$ a strategic advantage over those not offering such a remuneration scheme.

She concludes that when only few firms offer $\mathcal{PS}$, their profitability increases, but when the majority of firms offers $\mathcal{PS}$, each obtains lower profits than under a universal fixed wage scheme.

However, none of these papers considers imperfectly substitutable goods, coordinated bargaining, or Bertrand competition in the product market. Moreover, they do not endogenize the workers' decision to form a sector-wide union or firm-specific unions. We contribute to the existing literature by pointing out that (i) workers are always better–off when they coordinate their bargaining efforts in a sector–wide union, making thus the analysis of coordinated bargaining all the more important; (ii) coordinated bargaining makes the appearance of profit–sharing schemes more likely and under some circumstances, ex–ante symmetric firms may end up ex–post asymmetric as they choose different remuneration schemes in equilibrium; (iii) the more differentiated the goods are, the less likely is that firms offer profit–sharing schemes, independently of the bargaining regime; and (iv) Bertrand competition never provides incentives for firms to adopt profit–sharing schemes.

There is also an extensive empirical literature on the usage and the effects of profit–sharing schemes. Sesil et al. (2002) study 229 US major *New Technology* firms (pharmaceuticals, semiconductors etc.) that offer broad-based profit–sharing schemes. Comparing to their rivals that do not offer $\mathcal{PS}$, those firms' productivity increases by 4%, total shareholder returns increase by 2%, and profit level increases by 14%. Kraft and Ugarkovic (2005), using panel data from more than 2,000 German firms from 1998 to 2002, report that the introduction of a $\mathcal{PS}$ improves firms' profitability. Kruse (1992), using data from almost 3,000 US firms from 1971 to 1985, reports that the introduction of a $\mathcal{PS}$ is associated with a productivity increase of 2.8% to 3.5% for manufacturing firms, and 2.5% to 4.2% for non-manufacturing firms. Kruse suggests that only the most profitable and most productive firms offer profit–sharing schemes in order to align firm's and workers' interests, and through this alignment to reach new, higher levels of profitability and market share. Long and Fang (2012), using data from more than 1,700 Canadian firms from 1999 to 2001, shows that the introduction of a $\mathcal{PS}$ could increase real employee earnings growth up to 15% over a five–year period. In a recent paper, Fang (2016) reviews empirical studies showing that profit–sharing is beneficial for employees through higher income and employment stability, and for employers through higher productivity and profitability.[7] Moreover, a profit–sharing scheme reduces the supervision costs and is a remedy for shirking behavior, while at the same time creates a bigger flexibility in wages. Our findings are in line with the aforementioned empirical literature. First, the introduction of a profit–sharing scheme (typically) increases aggregate employment and firms' market shares and gross profits. Second, profit–sharing schemes increase wage flexibility as they allow a trade–off between lower wages and higher profit shares. Third, there are sectors in which some firms offer $\mathcal{PS}$, while their rivals do not, with the former obtaining higher profit levels. And finally, profit–sharing schemes often lead to higher real earnings per employee.[8]

The remainder of the paper is organized as follows. In section 3.2 we describe the model structure, the sequence of events and the bargaining framework. We, also, analyze the benchmark case in which both firms offer a fixed wage scheme. In section 3.3, we characterize the equilibrium outcomes under different unionization structures and remuneration schemes and determine the equilibrium remuneration schemes under decentralized and coordinated bargaining. We, also, determine the equilibrium unionization structure. We perform a welfare analysis in section 3.5. In section 2.5 we extend our analysis by assuming Bertrand competition in the product market. Finally, section 3.7 offers the concluding remarks. All proofs are relegated to section 3.8.

[7]It is well documented that the use of profit–sharing could increase employees' productivity through the attraction and retention of high–quality human capital, which could be translated into higher levels of firms' profitability. (Bhargava and Jenkinson (1995) for the UK, Cahuc and Dormont (1997) for France, Kato and Morishima (2003) for Japan, Long and Fang (2012) for Canada, and Kato et al. (2010) for Korea). On a recent paper, Bryson et al. (2016) shows that group–based performance schemes, such as a profit–sharing scheme, are associated with higher job satisfaction, and could help mitigate the negative effects of exposure to bad job quality.

[8]In our context, this holds under the equilibrium coordinated bargaining regime, but not under decentralized bargaining.

1.2 The model

1.2.1 Market structure and remuneration schemes

Consider an economy with two sectors: a competitive non-unionized sector (the "numeraire") and an oligopolistic unionized sector in which two firms, namely F_i and F_j, produce a horizontally differentiated good and compete in quantities. F_i is facing the following inverse demand function $p_i = \alpha - q_i - \gamma q_j$, where p_i and q_i are retail price and quantity, while $0 < \gamma < 1$ is the degree of product's substitutability, and $\alpha > 0$.[9] Both firms are endowed with constant returns to scale technology that transforms one unit of labor into one unit of final good: $q_i = L_i$, where L_i is F_i's employment level.[10]

Each firm faces a constant non-labor marginal cost c, which is normalized to zero. Regarding the labor costs, we distinguish the following two cases. First, if F_i is using a $\mathcal{FS}$, its unitary and marginal labor cost is the firm-specific wage rate w_i. Second, if F_i is using a $\mathcal{PS}$ then F_i pays w_i per unit of labor plus a lump-sum transfer to its workers equal to $s_i\pi_i$, where $0 < s_i < 1$ is the profit share ratio and π_i are its gross profits.

The oligopolistic sector is unionized and all the workers have identical skills. Workers are organized either in two firm-specific unions, U_i and U_j (decentralized bargaining case, $\mathcal{D}$), or in one sector-wide union U (coordinated bargaining case, $\mathcal{C}$). The union's objective is *rent maximization* (Oswald, 1982). Under $\mathcal{FS}$, this is simply the workers' total wage surplus (i.e., the difference between total wage bill w_i and the workers' outside option w_0.) Under $\mathcal{PS}$, the union cares also for the profit share transferred to its members. In particular, F_i's specific

[9] In particular, following Singh and Vives (1984), we consider a unit mass of identical consumers, each having a utility function $u(q_i, q_j) = a(q_i + q_j) - (q_i^2 + q_j^2 + 2\gamma q_i q_j)/2 + m$, with m denoting the quantity of the "numeraire"sector's good whose price has been normalized to 1. Notice that the lower the γ is, the more the goods are differentiated.

[10] This is standard in the existing literature. It implicitly assumes that firms' production technologies are of Leontief type and that their capital is sufficiently large.

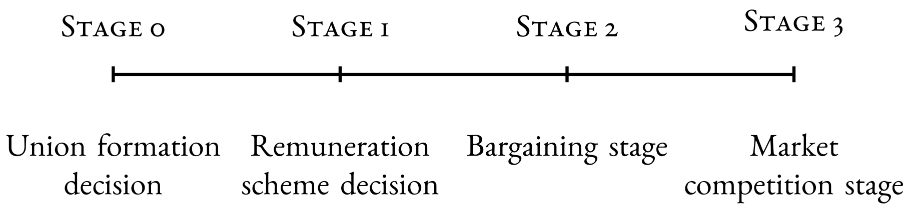


Figure 1.1: Game Timeline

union maximizes a Stone-Geary form utility function:

$$
\begin{aligned}
U_i &= (w_i - w_0)L_i & \text{under } \mathcal{FS}\text{, and} \\
U_i &= (w_i - w_0)L_i + s_i\pi_i & \text{under } \mathcal{PS}\text{,}
\end{aligned}
\tag{1.1}
$$

where $0 < w_0 < \alpha$ is the worker's outside option.[11] A sector-wide union maximizes

$$
\begin{aligned}
U &= \textstyle\sum_{i=1}^{2}[(w_i - w_0)L_i] & \text{under } \mathcal{FS}\text{, and} \\
U &= \textstyle\sum_{i=1}^{2}[(w_i - w_0)L_i + s_i\pi_i] & \text{under } \mathcal{PS}\text{.}
\end{aligned}
\tag{1.2}
$$

1.2.2 Sequence of events and bargaining framework

We consider a four-stage game with observable actions (Figure 3.1). This timing allows us to capture the strategic value of a firm's commitment to a specific remuneration scheme.

Stage 0: Union formation stage. Workers decide whether to form two firm-specific unions (decentralized bargaining case, $\mathcal{D}$) or to form a sector-wide union and coordinate their bargaining efforts (coordinated bargaining case, $\mathcal{C}$).

Stage 1: Remuneration scheme stage. Firms, simultaneously and separately, decide whether to offer a $\mathcal{FS}$ or a $\mathcal{PS}$ to their workers. Under a $\mathcal{PS}$, F_i commits to transfer to its workers a portion of its profits (the specific value of which to be subject of the negotiations at a later stage). As a consequence, the following scenarios could arise: Both firms offering either $\mathcal{FS}$

[11] In this setting, w_0 can be seen as the wage a worker could earn in the competitive sector of the economy. One of the key findings in Bryson (2014) is that workers organized in trade unions benefit from higher wages, so the difference $w_i - w_0$ can, also, be seen as the union wage premium.

(universal $\mathcal{FS}$ case) or $\mathcal{PS}$ (universal $\mathcal{PS}$ case), and one firm offering a $\mathcal{FS}$ while the other offers a $\mathcal{PS}$ (mixed cases).

Stage 2: Bargaining stage. Under decentralized bargaining, the two firm-union pairs (vertical chains) negotiate simultaneously and separately over the issue(s) included in their respective bargaining agendas. If F_i chooses to offer an $\mathcal{FS}$, then the (F_i, U_i) pair negotiates over w_i alone. Alternatively, if F_i commits to offer a profit-sharing scheme, then the (F_i, U_i) pair negotiates over both w_i and the profit sharing ratio s_i. Under coordinated bargaining, each firm and a representative of the sector-wide union negotiate in simultaneous and separate sessions over the issue(s) included in their respective bargaining agendas. (F_i, U) negotiate over w_i or (w_i, s_i) if F_i has opted for $\mathcal{FS}$ or $\mathcal{PS}$, respectively, in stage 1. In each bargaining session, the union and the firm have bargaining powers β and $(1-\beta)$, $0 < \beta < 1$, respectively.[12]

Stage 3: Market competition stage. Firms choose simultaneously their employment and output levels. Note that this is a "right-to-manage"model, i.e., firms have the right to choose their employment levels. (In the extensions, we briefly consider Bertrand competition in the product market.)

To solve this dynamic multi-stage game, we evoke the *Nash-in-Nash* solution concept: the Nash equilibrium of the two Nash bargaining solutions. We also assume that the negotiated outcome of a bargaining pair is non-contingent on whether the rival pair has reached or not an agreement.[13] Moreover, to obtain a unique equilibrium under coordinated bargaining, we impose pairwise proofness on the equilibrium agreements. That is, we require that

[12]As is standard, the bargaining power β is assumed to be exogenous. In fact, it is determined by various factors, such as the legal framework, the firm's internal organization, the union's ability to strike, the firm's costs of hiring, training, and firing, the unemployment rates, the difficulties to match firms' needs with workers' skills, labour market frictions, etc. Using data from 12 major US unionized firms from mid 1950's to late 1970's, Svejnar (1986) shows that the union's bargaining power was: for Ford's union $\beta = 0.25$, for Boeing's union $\beta = 0.86$, for US Steel's union $\beta = 0.36$, and for Rockwell's union $\beta = 0.85$.

[13]Non-contingency states that any breakdown in the negotiations between F_i and U_i (or U) will be non-permanent and non-irrevocable, and this is common knowledge (Horn and Wolinsky, 1988). This will lead pair F_j and U_j (or U) to bargain in a bilateral monopoly fashion, with F_j selling monopoly quantity in case of breakdown in the rival pair, but facing the same wage rate w_j and the same profit share percentage s_j as under duopoly. In other words, in case of a breakdown in the negotiations between F_i and U_i (or U), F_j and U_j (or U) do not renegotiate their remuneration terms (Milliou and Petrakis, 2007).

the negotiated agreement between U and F_i is immune to a bilateral deviation of U with the rival firm F_j, holding the agreement with F_i constant.[14]

1.2.3 The benchmark case: Universal $\mathcal{FS}$ regime

We will briefly present the benchmark case in which both firms offer fixed wage schemes. In the last stage of the game, F_i chooses employment level and output to maximize its net profits: $\pi_i = (\alpha - q_i - \gamma q_j - w_i)q_i$. Note that F_i's decision will remain the same under a profit sharing scheme too, as in the latter case it maximizes its net profits $(1-s_i)\pi_i$, where s_i is fixed as it has been determined at an earlier stage. The first order condition (foc) gives rise to the following reaction function:

$$q_i(q_j, w_i) = \tfrac{1}{2}(\alpha - \gamma q_j - w_i)$$

A decrease in w_i shifts q_i upwards and turns F_i into a more aggressive competitor in the product market. Solving the system of reaction functions, we obtain the equilibrium outputs, employment levels and profits:

$$q_i^*(w_i, w_j) = L_i^*(w_i, w_j) = \frac{\alpha(2-\gamma) - 2w_i + \gamma w_j}{4-\gamma^2}$$

$$\pi_i^*(w_i, w_j) = [q_i^*(w_i, w_j)]^2$$

In stage 2, firm–union pairs bargain simultaneously and separately, each over its firm-specific wage rate. We consider in turn the decentralized and the coordinated bargaining cases.

[14]Note that pairwise proofness and passive beliefs are closely related. Passive beliefs are appropriate when we perceive the asymmetric generalized Nash bargaining solution as the limit equilibrium of an alternating offers-counter-offers non-cooperative bargaining game (Binmore et al., 1986). In that case, passive beliefs state that F_i will handle any out-of-equilibrium offer from U as a "tremble", uncorrelated with any offer from U to rival F_j. That is, F_i believes that under any offer received from U, the pair U and F_j has reached an equilibrium outcome. Note that alternative beliefs lead to different equilibrium outcomes (McAfee and Schwartz, 1994, 1995).

Decentralized bargaining

Under decentralized bargaining, F_i and its firm-specific union U_i choose w_i to maximize their generalized asymmetric Nash product, taking as given the wage rate of the rival pair w_j:

$$NP_i^{\mathcal{DF}}(w_i, w_j) = [\pi_i^*(w_i, w_j)]^{1-\beta}[(w_i - w_0)q_i^*(w_i, w_j)]^{\beta} \tag{1.3}$$

where superscript $\mathcal{DF}$ stands for decentralized bargaining over a fixed wage. Note that in this case, the disagreement payoffs are nil for both F_i and U_i. From the foc, we obtain the reaction function of the bargaining pair (F_i, U_i):

$$w_i(w_j) = \tfrac{1}{4}[\alpha\beta(2-\gamma) + 2(2-\beta)w_0 + \beta\gamma w_j]$$

Notice that wages are strategic complements: an increase in w_j, allows (F_i, U_i) to agree on a higher wage rate. By symmetry, we get the equilibrium wage rate, employment and output:

$$\begin{aligned} w^{\mathcal{DF}} &= w_0 + \frac{\beta(2-\gamma)\tilde{\alpha}}{4-\beta\gamma} \\ L^{\mathcal{DF}} = q^{\mathcal{DF}} &= \frac{2(2-\beta)\tilde{\alpha}}{(2+\gamma)(4-\beta\gamma)} \end{aligned} \tag{1.4}$$

where: $\tilde{\alpha} = \alpha - w_0 > 0$. The following Lemma summarizes:

Lemma 1. *When firms bargain with their firm-specific unions ($\mathcal{D}$) over a fixed wage remuneration scheme ($\mathcal{FS}$):*

(i) Equilibrium wages are above the competitive wage: $w^{\mathcal{DF}} > w_0$.

(ii) The higher the union's bargain power, the more capable it is to negotiate a higher wage: $\frac{\partial w^{\mathcal{DF}}}{\partial \beta} > 0$.

(iii) The closer substitutes the two goods are, the higher is the competitive pressure, thus the more valuable it is to be aggressive in the product market: $\frac{\partial w^{\mathcal{DF}}}{\partial \gamma} < 0$.

The intuition is straightforward. The mere existence of a union pushes wages above the competitive wage (i.e., the workers' outside option). A stronger union is able to negotiate higher wages for its members. Moreover, as goods become less differentiated and the competitive pressure increases for the firms, unions make more wage concessions in order to save jobs for their members. Note also that employment level and output are decreasing in both the union's bargaining power and the degree of product substitutability.

Coordinated bargaining

Under coordinated bargaining, F_i bargains with a representative of the sector-wide union U over the firm-specific wage w_i, taking as given the rival wage w_j negotiated between F_j and U. In this case, the disagreement payoffs are nil, again, for F_i, but positive for U. If U fails to reach an agreement with F_i, it can still extract economic rents from offering workers to rival F_j at the negotiated wage w_j. As F_j becomes now a monopolist in the product market, its output (equals employment) level is $q_j^m(w_j) = \frac{1}{2}(\alpha - w_j)$. Hence, U's disagreement payoff (or else *outside option*) is: $(w_j - w_0)q_j^m(w_j)$. Therefore, w_i is chosen to maximize the generalized asymmetric Nash product:

$$NP_i^{\mathcal{CF}}(w_i, w_j) = [\pi_i^*(w_i, w_j)]^{1-\beta}[U^{\mathcal{CF}}(w_i, w_j) - (w_j - w_0)q_j^m(w_j)]^{\beta}, \qquad (1.5)$$

where the superscript $\mathcal{CF}$ stands for coordinated bargains over a fixed wage and

$$U^{\mathcal{CF}}(w_i, w_j) = \sum_{i=1, j \neq i}^{2} [(w_i - w_0)q_i^*(w_i, w_j)].$$

are the aggregate economic rents extracted by U. From the foc, we get the (F_i, U)'s reaction function

$$w_i(w_j) = \tfrac{1}{4}[\alpha\beta(2-\gamma) + (2-\gamma)(2-\beta)w_0 + 2\gamma w_j]$$

Once again, wages are strategic complements (Bulow et al., 1985). An increase in w_j will cause an increase in w_i. By imposing symmetry, the equilibrium wage rate, employment and output are:

$$w^{\mathcal{CF}} = w_0 + \tfrac{1}{2}\beta\tilde{\alpha}$$
$$L^{\mathcal{CF}} = q^{\mathcal{CF}} = \frac{(2-\beta)\tilde{\alpha}}{2(2+\gamma)} \tag{1.6}$$

The following Lemma summarizes.

Lemma 2. *When firms bargain with a sector-wide union ($\mathcal{C}$) over a fixed wage remuneration scheme ($\mathcal{FS}$):*

(i) Wages bargained by the sector-wide union are always higher than those bargained by the firm-specific unions: $w^{\mathcal{CF}} > w^{\mathcal{DF}} > w_0,\ \forall\beta,\gamma$.

(ii) The higher the union's bargaining power, the more capable it is to negotiate higher wages: $\frac{\partial w^{\mathcal{CF}}}{\partial\beta} > 0$.

(iii) The negotiated wage $w^{\mathcal{CF}}$ *is independent of the degree of product substitutability:* $\frac{\partial w^{\mathcal{CF}}}{\partial\gamma} = 0$.

As expected, U can effectively coordinate workers' bargaining efforts, and thus can achieve higher wages, compared to U_i. The more powerful the union is, the higher are the negotiated wages. Interestingly, in the coordinated bargaining, wages are independent of the degree of product differentiation. This is in line with Dhillon and Petrakis (2002) who have shown that this *wage rigidity* result applies to other market features too, such as the number of firms in the industry. In this case too, employment level and output are decreasing in both β and γ.

1.3 Equilibrium remuneration schemes

In this section we determine the configuration of remuneration schemes that arise in equilibrium. We consider in turn the decentralized and the coordinated bargaining cases. Remember that, independently whether a firm offers a $\mathcal{FS}$ or a $\mathcal{PS}$ remuneration scheme, the equilibrium outcome of stage 3 is the same as in the benchmark case.

1.3.1 Decentralized bargaining

Under decentralized bargaining, in stage 2 each firm and its firm–specific union bargain over the terms of the remuneration scheme that the firm has chosen in stage 1. Besides the benchmark case in which both firms offer a $\mathcal{FS}$ in stage 1 that has been analyzed above (the universal $\mathcal{FS}$ regime), there are two additional cases: (a) the universal $\mathcal{PS}$ regime, in which both firms offer a $\mathcal{PS}$, and (b) the mixed regime in which one firm offers a $\mathcal{FS}$ and the other offers a $\mathcal{PS}$.

Universal $\mathcal{PS}$ regime

In this case, (F_i, U_i) pair negotiates over the two issues included in their bargaining agenda: the wage rate w_i and the profit sharing ratio s_i. In particular, they choose (w_i, s_i) to maximize their generalized asymmetric Nash product:

$$NP_i^{\mathcal{DP}}(w_i, w_j, s_i) = [(1 - s_i)\pi_i^*(w_i, w_j)]^{1-\beta}[(w_i - w_0)q_i^*(w_i, w_j) + s_i\pi_i^*(w_i, w_j)]^{\beta} \quad (1.7)$$

where superscript $\mathcal{DP}$ stands for a decentralized bargain over a profit sharing scheme. Again, the disagreement payoffs are nil for both parties. Note that as the involved parties negotiate over two variables, the resulting bargaining outcome turns out to be *bilaterally efficient*, i.e., it maximizes (F_i, U_i) pair's joint surplus $\pi_i^*(w_i, w_j) + (w_i - w_0)q_i^*(w_i, w_j)$, given the bargaining outcome of the rival pair. In fact, w_i is chosen to maximize the joint surplus and s_i to split the maximized joint surplus to F_i and U_i according to their bargaining powers $(1 - \beta)$ and β, respectively.[15]

Maximizing $NP_i^{\mathcal{DP}}$ over w_i and s_i and exploiting symmetry, we get the equilibrium wage

[15]Maximizing $NP_i^{\mathcal{DP}}(w_i, w_j, s_i)$ w.r.t. s_i we obtain $s_i^*(w_i, w_j)\pi_i^*(w_i, w_j) = \beta[\pi_i^*(w_i, w_j)] - (1 - \beta)[(w_i - w_0)q_i^*(w_i, w_j)]$. Substituting this back to $NP_i^{\mathcal{DP}}(w_i, w_j, s_i)$, we get that the latter is proportional to (F_i, U_i)'s joint surplus. This is in line with the outcome of Nash bargaining games with transfer payments (see e.g. O'Brien and Shaffer (1992)).

rate, profit sharing ratio, and employment and output:

$$
\begin{aligned}
w^{\mathcal{DP}} &= w_0 - \frac{\gamma^2\tilde{\alpha}}{4+\gamma(2-\gamma)} \\
s^{\mathcal{DP}} &= \beta + \frac{1}{2}(1-\beta)\gamma^2 \\
L^{\mathcal{DP}} = q^{\mathcal{DP}} &= \frac{2\tilde{\alpha}}{4+\gamma(2-\gamma)}
\end{aligned}
\tag{1.8}
$$

It can be readily verified that $0 < s^{\mathcal{DP}} < 1, \quad \forall \beta, \gamma \in (0,1)$. The following Lemma summarizes:

Lemma 3. *When firms bargain with their firm-specific unions ($\mathcal{D}$) over a profit sharing scheme ($\mathcal{PS}$):*

(i) Negotiated wages are below the competitive wage, $w^{\mathcal{DP}} < w_0$.

(ii) A stronger union gets a higher profit share ratio, $\frac{\partial s^{\mathcal{DP}}}{\partial \beta} > 0$, but it doesn't get a higher wage, $\frac{\partial w^{\mathcal{DP}}}{\partial \beta} = 0$.

(iii) As the degree of product substitutability increases, the negotiated wage decreases, while the profit sharing ratio increases: $\frac{\partial w^{\mathcal{DP}}}{\partial \gamma} < 0$ and $\frac{\partial s^{\mathcal{DP}}}{\partial \gamma} > 0$.

This is an interesting result. The bargained wages are below the union's reservation wage (i.e., the competitive wage).[16] In a sense, the union "subsidizes" its firm. A firm–union pair agrees on a low wage rate in order to make the firm more aggressive in the product market. It thus increases its joint surplus which is then divided between the negotiating parties according to their respective bargaining powers. Clearly, the overall compensation of each worker, i.e., the sum of its wage $w^{\mathcal{DP}}$ plus its individual share from the firm i's profits, $\frac{s^{\mathcal{DP}}\pi^{\mathcal{DP}}}{L^{\mathcal{DP}}}$, is well above the competitive wage w_0. For the same reason, a stronger union has no incentive to push for a higher wage rate. A higher wage can only shrink the joint surplus which, as the union gets anyway a fixed portion β of its maximized value, is translated to lower union rents. Clearly, the stronger the union is, the higher is its rents. As expected, stronger competitive pressure (as expressed by a higher γ) leads to lower bargained wages, which however are

[16] In some countries, like France, it is forbidden to substitute the profit share for the base wage (Cahuc and Dormont, 1997). In this case: $w^{\mathcal{DP}} \equiv w_0$ and $s^{\mathcal{DP}} = \beta$ while $L^{\mathcal{DP}} = q^{\mathcal{DP}} = \frac{\tilde{\alpha}}{2+\gamma}$.

accompanied by higher profit sharing ratios. Notice that in this case employment level and output are independent of the union's bargaining power, while they are again decreasing in γ.

Mixed regime

Under the mixed regime, and without any loss of generality, let (F_i, U_i) pair bargain over a $\mathcal{PS}$ and (F_j, U_j) pair bargain over a $\mathcal{FS}$. The former pair bargains over both w_i and s_i, while the latter pair bargains only over w_j. The different generalized asymmetric Nash products are:

$$NP_i^{\mathcal{DM}}(w_i, w_j, s_i) = [(1-s_i)\pi_i^*(w_i, w_j)]^{1-\beta}[(w_i - w_0)q_i^*(w_i, w_j) + s_i\pi_i^*(w_i, w_j)]^{\beta} \quad (1.9)$$

$$NP_j^{\mathcal{DM}}(w_i, w_j) = [\pi_j^*(w_i, w_j)]^{1-\beta}[(w_j - w_0)q_j^*(w_i, w_j)]^{\beta}, \quad (1.10)$$

where superscript $\mathcal{DM}$ stands for decentralized bargains over mixed remuneration schemes. As (F_i, U_i) pair disposes of two instruments, is able to maximize joint surplus and then divide it according to bargain power. That's not the case for the other pair (F_j, U_j). Solving the system of focs, we get the equilibrium wage rates, profit sharing ratio, and employment levels and outputs:

$$\begin{aligned}
w_i^{\mathcal{DM}} &= w_0 - \frac{(2-\gamma)\gamma^2(4+\beta\gamma)\tilde{\alpha}}{32+\beta\gamma^4-16\gamma^2} \\
s_i^{\mathcal{DM}} &= \beta + \tfrac{1}{2}(1-\beta)\gamma^2 \\
w_j^{\mathcal{DM}} &= w_0 + \frac{\beta(2-\gamma)(2+\gamma)(4-2\gamma-\gamma^2)\tilde{\alpha}}{32+\beta\gamma^4-16\gamma^2} \\
q_i^{\mathcal{DM}} = L_i^{\mathcal{DM}} &= \frac{2(2-\gamma)(4+\beta\gamma)\tilde{\alpha}}{32+\beta\gamma^4-16\gamma^2} \\
q_j^{\mathcal{DM}} = L_j^{\mathcal{DM}} &= \frac{2(2-\beta)(4-2\gamma-\gamma^2)\tilde{\alpha}}{32+\beta\gamma^4-16\gamma^2}
\end{aligned} \quad (1.11)$$

Again, it is easy to check that $0 < s_i^{\mathcal{DM}} < 1, \quad \forall \beta, \gamma \in (0,1)$. The following Lemma summarizes:

Lemma 4. *When firms bargain with their firm-specific unions ($\mathcal{D}$) and offer different remu-*

neration schemes ($\mathcal{MS}$):

(i) The wage of the firm offering a $\mathcal{PS}$ is below the competitive wage, while the wage of the firm offering a $\mathcal{FS}$ is above the competitive wage: $w_i^{\mathcal{DM}} < w_0 < w_j^{\mathcal{DM}}$.

(ii) The stronger the union of a firm that offers a $\mathcal{PS}$ ($\mathcal{FS}$), the lower (higher) is the negotiated wage: $\frac{\partial w_i^{\mathcal{DM}}}{\partial \beta} < 0$ and $\frac{\partial w_j^{\mathcal{DM}}}{\partial \beta} > 0$.

(iii) Both wages decrease with the degree of the product's substitutability: $\frac{\partial w_i^{\mathcal{DM}}}{\partial \gamma} < 0$ and $\frac{\partial w_j^{\mathcal{DM}}}{\partial \gamma} < 0$.

The intuition for (i) and (iii) are along the lines of our discussion below Lemmata 1 and 3. Interestingly, as the union of the firm offering a profit sharing remuneration scheme becomes stronger, it agrees on a higher subsidization rate (i.e., $w_i^{\mathcal{DM}}$ decreases). In this way, its firm becomes more aggressive in the product market and the firm–union's (maximized) joint surplus increases, a fixed portion β of which the union then enjoys. On the other hand, the union of the firm offering a fixed wage scheme naturally presses for a higher wage as its bargaining power increases. Interestingly, and in contrast to those of the firm offering $\mathcal{FS}$, the employment level and output of the firm offering $\mathcal{PS}$ is increasing in the union's bargaining power and may also increase with γ but only if the products are close substitutes. Finally, notice that the profit sharing ratio of a firm offering $\mathcal{PS}$ is the same independently whether the rival firm offers $\mathcal{PS}$ or $\mathcal{FS}$ ($s^{\mathcal{DP}} = s_i^{\mathcal{DM}}$). Yet, its wage rate is higher under universal $\mathcal{PS}$ than in the mixed regime ($w^{\mathcal{DP}} > w_i^{\mathcal{DM}}$).

Equilibrium remuneration schemes under decentralized bargaining

In this subsection we determine the remuneration schemes that arise in equilibrium. Firms choose simultaneously between offering a fixed wage or a profit sharing scheme. If both firms offer $\mathcal{FS}$, each firm makes net profits $\pi^{\mathcal{DF}} = (q^{\mathcal{DF}})^2$; if both firms offer $\mathcal{PS}$, each firm makes net profits $\pi^{\mathcal{DP}} = (1 - s^{\mathcal{DP}})(q^{\mathcal{DP}})^2$; if F_i offers a $\mathcal{PS}$, and F_j offers a $\mathcal{FS}$, then the net profits per firm are: $\pi_i^{\mathcal{DM}} = (1 - s_i^{\mathcal{DM}})(q_i^{\mathcal{DM}})^2$ and $\pi_j^{\mathcal{DM}} = (q_j^{\mathcal{DM}})^2$. The Nash equilibria of this matrix game are summarized in the following proposition and are illustrated in Figure 1.2.

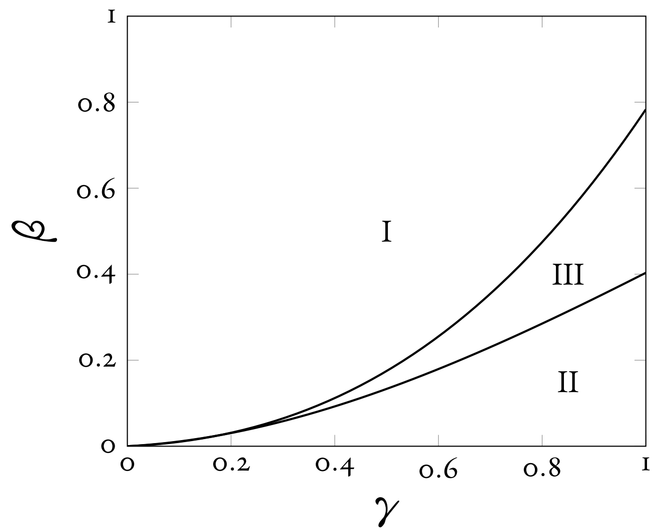


Figure 1.2: Equilibria under Decentralized Bargaining.

Proposition 1.3.1. *When firms bargain with their firm-specific unions, in equilibrium:*

(i) Both firms offer fixed wage schemes for all $\beta \geq \beta^{\mathcal{DF}}(\gamma)$, *with* $\frac{d\beta^{\mathcal{DF}}}{d\gamma} > 0$, $\beta^{\mathcal{DF}}(0) = 0$ *and* $\beta^{\mathcal{DF}}(1) = 0.373$ *(Areas I and III).*

(ii) Both firms offer profit sharing schemes for all $\beta \leq \beta^{\mathcal{DP}}(\gamma)$, *with* $\frac{d\beta^{\mathcal{DP}}}{d\gamma} > 0$, $\beta^{\mathcal{DP}}(0) = 0$ *and* $\beta^{\mathcal{DP}}(1) = 0.694$ *(Areas II and III).*

(iii) If $\beta^{\mathcal{DF}}(\gamma) \leq \beta \leq \beta^{\mathcal{DP}}(\gamma)$, *both universal* $\mathcal{FS}$ *and universal* $\mathcal{PS}$ *arise, with the former equilibrium Pareto dominating the latter (Area III).*

When the union's bargaining power is high enough, both firms offer fixed wage remuneration schemes. In contrast, when unions are not too powerful, both firms offer profit sharing schemes to their workers. By introducing a $\mathcal{PS}$, a firm will face a substantially lower unit labor cost and will thus have a strong competitive advantage in the product market. A firm with a weak union (low β) will then enjoy the bulk of the additional profits. Nevertheless, if both firms offer a profit sharing remuneration scheme, they are trapped into a prisoner's dilemma and make lower profits than under universal $\mathcal{FS}$. Note that asymmetric equilibria never arise under decentralized bargaining; also that for intermediate values of β, there are multiple equilibria with the universal $\mathcal{FS}$ equilibrium Pareto dominating the universal $\mathcal{PS}$ one. Finally, the higher is the competitive pressure (higher γ), the more likely is for firms to offer profit sharing schemes.

1.3.2 Coordinated bargaining

Under coordinated bargaining, in stage 2 each firm bargains with a representative of the sector-wide union. Bargaining sessions are separate and simultaneous, and each (F_i, U) pair negotiates over the terms of the remuneration scheme that F_i has chosen in stage 1. As the universal $\mathcal{FS}$ regime has been analyzed above, we conduct the analysis of the universal $\mathcal{PS}$ and the mixed regimes in the sequel.

Universal $\mathcal{PS}$ regime

In this case, F_i bargains with a representative of the sector-wide union U over the firm-specific wage w_i and the profit sharing ratio s_i, taking as given the (w_j, s_j) bargained between F_j and U. F_i's disagreement payoff is again nil, while that of U equals: $(w_j - w_0)q_j^m(w_j) + s_j\pi_j^m(w_j)$, where $q_j^m(w_j) = \frac{1}{2}(\alpha - w_j)$ and $\pi_j^m(w_j) = [q_j^m(w_j)]^2$ are the equilibrium output and profits of F_j while acting as a monopolist in the product market. This is because if U fails to reach an agreement with F_i, it can still get rents from offering workers to the monopolist F_j at the negotiated wage w_j and from enjoying a portion s_j of F_j's monopoly profits. Therefore, w_i and s_i are chosen to maximize the Nash product:

$$NP_i^{\mathcal{CP}}(w_i, w_j, s_i, s_j) = [(1 - s_i)\pi_i^*(w_i, w_j)]^{1-\beta}[U^{\mathcal{CP}}(w_i, w_j, s_i, s_j) - \\ - (w_j - w_0)q_j^m(w_j) - s_j\pi_j^m(w_j)]^{\beta}$$

where $\mathcal{CP}$ stands for coordinated bargaining over profit sharing schemes and,

$$U^{\mathcal{CP}}(w_i, w_j, s_i, s_j) = \sum_{i=1, j\neq i}^{2} [(w_i - w_0)q_i^*(w_i, w_j) + s_i\pi_i^*(w_i, w_j)]$$

are the aggregate economic rents extracted by the union from both firms. As each (F_i, U) pair disposes of two instruments (namely: wage w_i and profit share s_i), their negotiated outcome is, again, bilaterally efficient: it maximizes the pair's (excess) joint surplus, given the bargained outcome (w_j, s_j) of the rival pair.[17] From the focs and exploiting symmetry, we obtain the firms' equilibrium wage, profit sharing ratio, and employment and output levels:

$$\begin{aligned} w^{\mathcal{CP}} &= w_0 + \frac{[\beta(8-\gamma^2(4+\gamma)) - \gamma(4-4\gamma-\gamma^2)]\gamma\tilde{\alpha}}{16-2\gamma[6\gamma-(2+\gamma)(2\beta+(1-\beta)\gamma^2)]} \\ s^{\mathcal{CP}} &= \frac{2[2\beta+(1-\beta)\gamma^2]}{4-(1-\beta)\gamma^2} \\ L^{\mathcal{CP}} = q^{\mathcal{CP}} &= \frac{(2-\gamma)(4-(1-\beta)\gamma^2)\tilde{\alpha}}{16-2\gamma[6\gamma-(2+\gamma)(2\beta+(1-\beta)\gamma^2]} \end{aligned} \tag{1.12}$$

It can be readily verified that $0 < s^{\mathcal{CP}} < 1 \quad \forall \beta, \gamma \in (0,1)$. The following Lemma summarizes:

Lemma 5. *When firms bargain with a sector-wide union ($\mathcal{C}$) over profit-sharing schemes ($\mathcal{PS}$):*

(i) The negotiated wages are below the competitive wage only if the goods are differentiated enough and the union's bargaining power is low enough, i.e., $w^{\mathcal{CP}} < w_0$ only if $\gamma < 0.828$ and $\beta < \overline{\beta}(\gamma) \equiv \frac{\gamma(4-4\gamma-\gamma^2)}{8-\gamma^2(4+\gamma)}$. Otherwise: $w^{\mathcal{CP}} > w_0$.

(ii) The stronger the union is, the higher are the negotiated wages and profit sharing ratios: $\frac{\partial w^{\mathcal{CP}}}{\partial \beta} > 0$ and $\frac{\partial s^{\mathcal{CP}}}{\partial \beta} > 0$.

(iii) The negotiated profit sharing ratios always increase with the degree of product substitutability, $\frac{\partial s^{\mathcal{CP}}}{\partial \gamma} > 0$, while the negotiated wages increase with γ except if both γ and β are sufficiently low.

It can be readily verified that $w^{\mathcal{CP}} < w^{\mathcal{CF}}$ except if $\gamma > 0.828$ and $\beta < \widehat{\beta}(\gamma) \equiv \frac{\gamma^2+4\gamma-4}{\gamma(2+\gamma)}$, with $\frac{d\widehat{\beta}}{d\gamma} > 0$. The intuition behind this result is the following. When firms negotiate with a sector-wide union U over wages w_i and profit sharing ratios s_i, the union most often agrees

[17] In particular, w_i is chosen to maximize the joint surplus:

$$\pi_i^*(w_i, w_j) + \sum_{i=1, j\neq i}^{2} (w_i - w_0) q_i^*(w_i, w_j) - (w_j - w_0) q_j^m(w_j) - s_j \pi_j^m(w_j),$$

and s_i is chosen such that the maximized joint surplus is divided among the two parties according to their respective bargaining powers. Note that as the last two terms of the above expression do not depend on w_i, the (F_i, U)'s negotiated wage essentially maximizes their joint surplus.

on lower wages in exchange of higher profit sharing ratios. Further, and in contrast to the universal $\mathcal{FS}$ regime, under universal $\mathcal{PS}$ negotiated wages are sometimes below the competitive wage. This occurs only if the goods are rather poor substitutes ($\gamma > 0.828$) and the union's bargaining power is low enough. Under these circumstances, the positive effect on wages from the workers' coordination of bargaining efforts is outweighed by the negative effect from U's inability to (publicly) commit to wage rates. This is the well-known *commitment problem* (McAfee and Schwartz, 1994). F_i anticipates that U has incentives to behave opportunistically, i.e., to agree with F_j on a low wage rate (even below w_0) in order to make F_j more aggressive in the product market and enjoy thus its portion β of the higher (F_j, U)'s excess joint surplus. As a consequence, F_i will not agree on a wage well above w_0.[18] As expected, a stronger sector-wide union can put higher pressure to firms and obtain both higher wages and profit sharing ratios. Finally, as the goods become closer substitutes and the competitive pressure increases for firms, the union is more successful in coordinating its workers bargaining efforts, obtaining thus higher profit sharing ratios and (most often) higher wages. Finally, similar to the universal $\mathcal{FS}$ case, we check that employment level and output are decreasing in both β and γ.

Mixed regime

Under the mixed regime, let (F_i, U_i) pair bargain over a $\mathcal{PS}$ and (F_j, U_j) pair bargain over a $\mathcal{FS}$. Then the former pair chooses (w_i, s_i), while the latter pair chooses w_j, in order each to maximize its respective Nash product:

$$NP_i^{\mathcal{CM}}(w_i, w_j, s_i) = [(1 - s_i)\pi_i^*(w_i, w_j)]^{1-\beta}[U^{\mathcal{CM}}(w_i, w_j, s_i) - (w_j - w_0)q_j^m(w_j)]^\beta$$

$$NP_j^{\mathcal{CM}}(w_i, w_j, s_i) = [\pi_j^*(w_i, w_j)]^{1-\beta}[U^{\mathcal{CM}}(w_i, w_j, s_i) - (w_i - w_0)q_i^m(w_i) - s_i\pi_i^m(w_i)]^\beta,$$

[18]Notice that subsidization of firms under coordinated bargaining occurs only under some parameter values, in contrast to the decentralized bargaining case in which it occurs always.

where $\mathcal{CM}$ stands for coordinated bargaining over mixed remuneration schemes and,

$$U^{\mathcal{CM}}(w_i, w_j, s_i) = \sum_{i=1, j\neq i}^{2} [(w_i - w_0)q_i^*(w_i, w_j)] + s_i \pi_i^*(w_i, w_j)$$

are the aggregate economic rents extracted by the union from both firms. Each firm's disagreement payoff is nil, while those of the sector-wide union U are the same as the ones discussed in the universal $\mathcal{CF}$ and $\mathcal{CP}$ cases, respectively. Note that given w_j,the negotiated outcome of (F_i, U) is bilaterally efficient. Solving the system of focs, we obtain the equilibrium wages, profit sharing ratio, employment and output levels: [19]

$$\begin{aligned}
w_i^{\mathcal{CM}} &= w_0 + \frac{\Omega_i(\beta,\gamma)\gamma\tilde{\alpha}}{\Phi(\beta,\gamma)} \\
s_i^{\mathcal{CM}} &= \beta + \frac{1}{2}(1-\beta)\gamma^2 \\
w_j^{\mathcal{CM}} &= w_0 + \frac{\Omega_j(\beta,\gamma)\tilde{\alpha}}{2\Phi(\beta,\gamma)} \\
L_i^{\mathcal{CM}} = q_i^{\mathcal{CM}} &= \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)} \\
L_j^{\mathcal{CM}} = q_j^{\mathcal{CM}} &= \frac{(2-\beta)(2-\gamma)[4-(2-\gamma^2)\beta\gamma-(2+\gamma)\gamma^2]\tilde{\alpha}}{\Phi(\beta,\gamma)}.
\end{aligned} \tag{1.13}$$

Notice that $0 < s_i^{\mathcal{CM}} < 1, \forall \beta, \gamma \in (0,1)$. The following Lemma summarizes.

Lemma 6. *When firms bargain with a sector-wide union ($\mathcal{C}$) over mixed remuneration schemes ($\mathcal{MS}$):*

(i) The wage of the firm offering $\mathcal{FS}$ is always above that of the firm offering $\mathcal{PS}$, $w_j^{\mathcal{CM}} > w_i^{\mathcal{CM}}$. Moreover, $w_j^{\mathcal{CM}}$ is always above the competitive wage, $w_j^{\mathcal{CM}} > w_0$, while $w_i^{\mathcal{CM}}$ is above w_0 if and only if $\beta > \widetilde{\beta}(\gamma)$, with $\frac{d\widetilde{\beta}}{d\gamma} > 0$, $\widetilde{\beta}(0) = 0$, and $\widetilde{\beta}(1) = 1$.

(ii) The stronger the union is, the higher are both negotiated wages as well as F_i's profit sharing ratio, $\frac{\partial w_i^{\mathcal{CM}}}{\partial \beta} > 0$, $\frac{\partial w_j^{\mathcal{CM}}}{\partial \beta} > 0$ and $\frac{\partial s_i^{\mathcal{CM}}}{\partial \beta} > 0$.

(iii) As the products become closer substitutes, F_i's profit sharing ratio and F_j's negotiated

[19] $\Phi(\beta,\gamma) = 32 + [6(1-\beta) + 4\beta^2]\gamma^4 - (1-\beta)^2\gamma^6 - 4[6-(1-\beta)\beta]\gamma^2$
$\Omega_i(\beta,\gamma) = \beta(2-\gamma^2)[4+\gamma(2-\gamma-2\gamma^2) - \beta^2\gamma(2-\gamma^2)^2 - \gamma(8-(4-\gamma^2)(\gamma+\gamma^2))]$
$\Omega_j(\beta,\gamma) = [\gamma^3 - \beta^2\gamma(2-\gamma^2)][(8-\gamma^2(2+\gamma)) + 2\beta(16+8\gamma-12\gamma^2-\gamma^3(10-\gamma(1+\gamma)^2))]$

wage increase, $\frac{\partial s_i^{\mathcal{CM}}}{\partial \gamma} > 0$, $\frac{\partial w_j^{\mathcal{CM}}}{\partial \gamma} > 0$; *while* F_i*'s negotiated wage increases only if* γ *is low and* β *is high.*

Intuitively, as the (F_j, U) pair bargain over the wage rate alone, the sector-wide union agrees only if the latter is above the workers' outside option. In contrast, U may agree with F_i on a lower wage than w_0, subsidizing thus the firm and making it a strong competitor in the product market, because it will get back its share of the F_i's higher profits. This is the reason of why $w_j^{\mathcal{CM}} > w_i^{\mathcal{CM}}$ always holds. Further, the intuition behind (ii) and (iii) is along the lines explained in the previous subsection. The only exception is that (F_i, U)'s wage rate is often decreasing in γ, which is due to the flexibility of this bargaining pair to trade-off a lower wage rate with a higher profit sharing ratio. As above, the employment level and output of the firm offering $\mathcal{FS}$ are decreasing in both β and γ. In contrast, those of the firm offering $\mathcal{PS}$ is independent of the union's bargaining power and may increase with γ but only if the products are close substitutes. Finally, notice that both the profit sharing ratio and the wage rate of a firm offering $\mathcal{PS}$ is higher under universal $\mathcal{PS}$ than in the mixed regime ($s^{\mathcal{CP}} > s_i^{\mathcal{CM}}$ and $w^{\mathcal{CP}} > w_i^{\mathcal{CM}}$).

Equilibrium remuneration schemes under coordinated bargaining

In stage 1, each firm chooses between a fixed wage and a profit sharing remuneration scheme. As above, under universal $\mathcal{FS}$, $\pi^{\mathcal{CF}} = (q^{\mathcal{CF}})^2$; under universal $\mathcal{PS}$, $\pi^{\mathcal{CP}} = (1-s^{\mathcal{CP}})(q^{\mathcal{CP}})^2$; and under mixed schemes, $\pi_i^{\mathcal{CM}} = (1-s_i^{\mathcal{CM}})(q_i^{\mathcal{CM}})^2$ and $\pi_j^{\mathcal{CM}} = (q_j^{\mathcal{CM}})^2$. The Nash equilibria of this matrix game are summarized in the following proposition and are illustrated in Figure 1.3.

Proposition 1.3.2. *When firms bargain with a sector-wide union, in equilibrium:*

(i) Both firms offer fixed wage schemes for all $\beta \geq \beta^{\mathcal{CF}}(\gamma)$, *with* $\frac{d\beta^{\mathcal{CF}}}{d\gamma} > 0$, $\beta^{\mathcal{CF}}(0) = 0$ *and* $\beta^{\mathcal{CF}}(1) = 0.5$ *(Area I and III).*

(ii) Both firms offer profit sharing schemes for all $\beta \leq \beta^{\mathcal{CP}}(\gamma)$, *with* $\frac{d\beta^{\mathcal{CP}}}{d\gamma} > 0$, $\beta^{\mathcal{CP}}(0) = 0$ *and* $\beta^{\mathcal{CP}}(1) = 1$ *(Area II and III).*

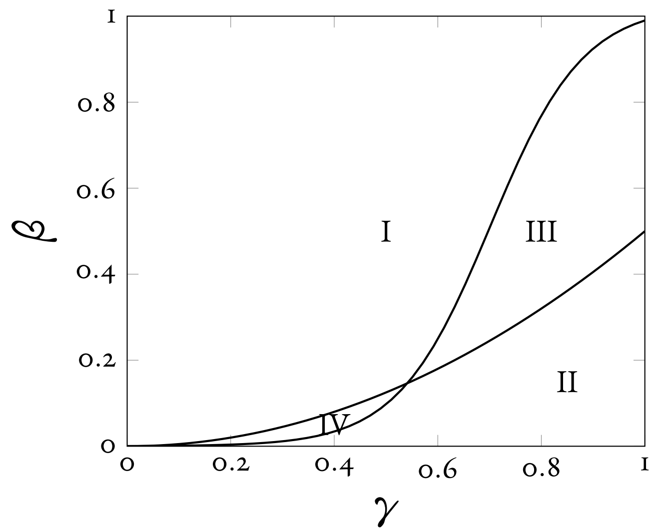


Figure 1.3: Equilibria under Coordinated Bargaining.

(iii) One firm offers $\mathcal{FS}$ *and the other offers* $\mathcal{PS}$ *when* $\gamma < 0.6208$ *and* $\beta^{\mathcal{CP}}(\gamma) \leq \beta \leq \beta^{\mathcal{CF}}(\gamma)$ *(Area IV).*

(iv) If $\gamma > 0.6208$ *and* $\beta^{\mathcal{CF}}(\gamma) \leq \beta \leq \beta^{\mathcal{CP}}(\gamma)$*, both universal* $\mathcal{FS}$ *and universal* $\mathcal{PS}$ *arise, with the former equilibrium Pareto dominating the latter (Area III).*

Under coordinated bargaining too, universal $\mathcal{FS}$ and $\mathcal{PS}$ equilibria arise under qualitatively similar conditions as those of the decentralized bargaining case. Moreover, these equilibria coexist (and are Pareto ranked) but only if the degree of product substitutability is high enough ($\gamma > 0.6208$). The intuition is along the lines explained in the decentralized bargaining case. In contrast to the latter case, under coordinated bargaining asymmetric equilibria arise, provided that γ is rather low and the union's power is neither too high nor too low. In this case, the firm offering a $\mathcal{PS}$ remuneration scheme makes higher profits than the firm offering a $\mathcal{FS}$ scheme. Clearly then, the former firm cannot benefit from switching to $\mathcal{FS}$. And the latter firm stays with $\mathcal{FS}$ in order to avoid the prisoner's dilemma ensuing under universal $\mathcal{PS}$.

1.3.3 Union formation stage

In stage 0, the workers decide whether to form two firm-specific unions U_i and U_j, or a sector-wide union U, taking into account the equilibria that each such decision induces in the continuation of the game. In case of the multiple equilibria in the remuneration scheme selection stage, it is reasonable to assume that firms will coordinate on the Pareto superior equilibrium, and that workers expect that firms will do so.

Proposition 1.3.3. *Workers always prefer to form a sector-wide union and conduct coordinated bargaining.*

Proposition 1.3.3 suggests that, independently of the union bargaining power and the degree of product substitutability (i.e., the competitive pressure) in the product market, workers prefer to coordinate their bargaining efforts by forming a sector-wide union. As a result, universal $\mathcal{FS}$, universal $\mathcal{PS}$, as well as mixed remuneration schemes are expected to prevail in the industry, depending on the specific values of β and γ (see Figure 1.3). Therefore, the analysis of the coordinated bargaining case turns out to be of great importance as it provides novel insights.[20] Under coordinated bargaining, all firms offering a profit sharing remuneration scheme is more likely than under decentralized bargaining - compare Figures 1.2 and 1.3. Moreover, and in contrast to the decentralized bargaining case, mixed remuneration schemes are likely to be observed under coordinated bargaining provided that products are sufficiently differentiated and the union is rather weak (but not too weak).

1.4 Welfare Analysis

In this section, we perform a welfare analysis and briefly discuss policy measures in order to improve on market outcomes. Social welfare is defined as the sum of consumer surplus, firms' profits and unions' rents:

$$SW = CS + (\pi_i + \pi_j) + U,$$

[20]In contrast, firms always prefer decentralized bargaining. In fact, $\pi^{\mathcal{DF}} > \pi^{\mathcal{CF}} > \pi^{\mathcal{DP}} > \pi^{\mathcal{CP}}$. Note that in line with the existing literature, the possibility of introducing profit–sharing schemes may lead firms to a prisoners' dilemma, independently of the unionization structure.

where $CS = \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$,[21] and $U = U_i + U_j$ under decentralized bargaining. Substituting the relevant expressions into CS and SW, and after some simple algebraic manipulations, we obtain the following proposition.

Proposition 1.4.1. *(i) The highest consumer surplus as well as social welfare is attained under decentralized bargaining and a universal profit–sharing scheme.*

(ii) $CS^{\mathcal{D}k} > CS^{\mathcal{C}k}$ *and* $SW^{\mathcal{D}k} > SW^{\mathcal{C}k}$, $k \in \{\mathcal{F}, \mathcal{P}, \mathcal{M}\}$.

(iii) $CS^{\mathcal{DP}} > CS^{\mathcal{DM}} > CS^{\mathcal{DF}}$ *and* $SW^{\mathcal{DP}} > SW^{\mathcal{DM}} > SW^{\mathcal{DF}}$.

(iv) $CS^{\mathcal{CP}} > CS^{\mathcal{CF}}$ *and* $SW^{\mathcal{CP}} > SW^{\mathcal{CF}}$ *except if* $\gamma > 0.828$ *and* $\beta > \beta_W(\gamma)$, *with:* $\frac{\partial \beta_W}{\partial \gamma} > 0$, $\beta_W(0.828) = 0$, *and* $\beta_W(1) = 0.333$.

The proof of the proposition can be found in the Appendix A2. Proposition 1.4.1 informs us that decentralized bargaining in which all firms offer profit sharing remuneration schemes is the most preferable regime in terms of both the consumers surplus and social welfare. This is mainly because in this case unions always "subsidize" their firms ($w^{\mathcal{DF}} < w_0$), which then produce large quantities in the market. In fact, aggregate employment/output and firms' gross profits are the highest under decentralized bargaining and universal $\mathcal{PS}$.[22] However, this situation will never arise in equilibrium if workers are allowed to choose their unionization structure (Proposition 1.3.3). A regulator should then institutionalize negotiations at the firm– instead of the sector–level. In fact, independently of the firms' choices of remuneration schemes, decentralization of bargaining leads always to higher consumers surplus and social welfare than coordinated bargaining (Proposition 1.4.1(ii)). Moreover, under decentralized bargaining, universal $\mathcal{PS}$ is welfare superior than any other configuration of remuneration schemes. Interestingly, this is not always so when workers coordinate their bargaining efforts by forming a sector-wide union. Consumers surplus and social welfare are

[21] We obtain the CS by substituting $p_i = a - q_i - \gamma q_j$ into the $u(q_i, q_j) - p_i q_i - p_j q_j$.

[22] It can be readily verified that $L^{\mathcal{D}k} > L^{\mathcal{C}k}$, $k \in \{\mathcal{F}, \mathcal{P}, \mathcal{M}\}$, i.e., aggregate employment is higher under decentralized than under coordinated bargaining for any given remuneration scheme configuration. Moreover, that $L^{\mathcal{DP}} > L_i^{\mathcal{DM}} + L_j^{\mathcal{DM}} > L^{\mathcal{DF}}$, i.e., aggregate employment is the highest under universal $\mathcal{PS}$ in the decentralized bargaining case. This is also true under coordinated bargaining except if $\gamma > 0.828$ and $\beta > \beta_W(\gamma)$. Clearly, a similar ranking holds for the firms' gross profits, as they are equal to the square of output/employment level. Finally, note that the firm offering $\mathcal{PS}$ in the mixed case produces more output and makes higher gross profits than under universal $\mathcal{PS}$.

lower under universal $\mathcal{PS}$ than under universal $\mathcal{FS}$ as long as products are too close substitutes and the union's bargaining power is too low. (Remember that under these circumstances $w^{\mathcal{CP}} > w^{\mathcal{CF}}$). With this exception in mind, our findings suggest that a policy maker should provide incentives to firms to offer profit sharing schemes to their workers.

1.5 Bertrand competition

In this section, we consider that firms compete in prices in the product market. It is well-known that prices are strategic complements and that this often leads to different strategic interactions than when firms compete in quantities. In fact, a firm's unit cost increase results to softer price competition in the market and may thus increase the "pie" to be split between the firm and the union during their negotiations. As a consequence, each firm-union pair does not anymore have incentives to make its firm more aggressive in the market. It turns out that profit sharing schemes do not arise in equilibrium under Bertrand competition. The following Proposition summarizes our findings (For a proof see 3.8 A1.)

Proposition 1.5.1. *Under Bertrand competition in the product market:*

(i) Universal $\mathcal{FS}$ is the unique equilibrium, independently whether workers form a sector-wide union or two firm-specific unions.

(ii) Workers are better off by forming a sector-wide union than two firm-specific unions.

Proposition 1.5.1 states that no matter which is the workers' decision at stage 0, in equilibrium both firms always offer a fixed wage remuneration scheme. Intuitively, a profit sharing scheme (typically) leads to a lower negotiated wage – there is a trade–off between wages and profit sharing ratios – and thus to lower prices and firms' profits. As a consequence, there will be a smaller surplus to be shared between the firm offering $\mathcal{PS}$ and the union. Therefore, no firm has incentives to unilaterally switch from $\mathcal{FS}$ to $\mathcal{PS}$. This is in sharp contrast to Cournot competition. Yet, in line with Cournot competition, workers have incentives to coordinate their bargaining efforts by forming a sector-wide union under Bertrand competition too.

Interestingly, our findings suggest that as the competitive pressure increases (measured by a move from a less competitive Cournot market to a more competitive Bertrand market), profit sharing schemes are less likely to be observed. This contrasts our previous finding that as the degree of product substitutability increases, which is an alternative measure of competitive pressure, it is more likely that $\mathcal{PS}$ arises in equilibrium.

1.6 Conclusions

Empirical evidence indicates that profit–sharing schemes are widespread and are common in many countries characterized by different labor market institutions and in particular, different unionization structures and unionization levels. Theoretical and empirical studies so far have emphasized the positive aspects of profit–sharing in aggregate employment, workers' productivity, firms' profitability and real employee earnings. Our paper has contributed to this literature by endogenizing the firms' decision to offer or not a profit–sharing scheme in a differentiated goods duopoly in which firms and union(s) bargain over the remuneration scheme selected by the firm.

We have shown that workers have always incentives to coordinate their bargaining efforts by forming a sector–wide union, which makes the analysis of the coordinated bargaining case of great importance. Under the latter bargaining regime and Cournot competition in the product market, asymmetric equilibria may arise in which one firm offers a profit–sharing scheme, while the other offers a fixed wage scheme. The latter never occurs under the decentralized bargaining regime that has exclusively been studied in the existing literature. We also show that under coordinated bargaining universal profit–sharing schemes are more prevalent than under decentralized bargaining. In addition, independently of the unionization structure, profit sharing schemes are more likely to be introduced when firms face union(s) with low bargaining power. Furthermore, competitive pressure as proxied by product substitutability favors the introduction of profit–sharing schemes. Finally, under Bertrand competition in the product market firms never use profit–sharing schemes, with universal fixed wage schemes being the unique equilibrium in this case.

We also have shown that aggregate employment, consumers surplus and social welfare are higher under decentralized bargaining and universal profit–sharing schemes. This finding suggests that a policymaker should facilitate the institutionalization of firm-level negotiations over remuneration schemes and should take policy measures to promote the adoption of profit–sharing schemes. Nevertheless, the policy measures should carefully be designed taking into account product and labor market characteristics, such as the mode of competition, the degree of product differentiation, the unionization structure and unionization level of the industrial sector under consideration.

Our findings lead to a number of testable implications. First, the usage of profit-sharing schemes in sectors with Bertrand type competition must be relatively low. On the contrary, in sectors with Cournot type competition, we should expect asymmetric equilibria to arise, especially when workers form a sector–wide union. Further, the usage of profit–sharing from firms in sectors with coordinated bargaining must be significantly higher compared to sectors with firm-specific unions.

There are a few questions still open in the theoretical literature. For instance, Manasakis and Petrakis (2009) analyze the impact of unionization structures on the firms' incentives to form research joint ventures (RJV's) aiming to split high R&D costs and share positive spillovers. An interesting direction for further research could be to study the role of profit–sharing schemes on the formation of research joint ventures, and whether a profit–sharing scheme could ease the hold–up problem provoked by the presence of powerful unions.

1.7 Appendix

1.7.1 A1: Bertrand Competition

Stage 3

Firms F_i and F_j simultaneously choose prices each to maximize its gross profits:

$$\pi_i = (p_i - w_i)(\frac{\alpha(1-\gamma) - p_i + \gamma p_j}{1-\gamma^2}),\ i,j = 1,2,\ i \neq j.$$

As under Cournot competition, the solution to the maximization problem does not depend on whether the firm offers a $\mathcal{FS}$ or $\mathcal{PS}$ remuneration scheme. Solving the system of the focs, we obtain the equilibrium prices, quantities, and (gross) profits:

$$
\begin{aligned}
p_i^*(w_i, w_j) =& \frac{\alpha(2-\gamma-\gamma^2) + 2w_i + \gamma w_j}{4-\gamma^2} \\
q_i^*(w_i, w_j) = L_i^*(w_i, w_j) =& \frac{a(2-\gamma-\gamma^2) - (2-\gamma^2)w_i + \gamma w_j}{4 - 5\gamma^2 + \gamma^4} \\
\pi_i^*(w_i, w_j) =& (1-\gamma^2)[q_i^*(w_i, w_j)]^2
\end{aligned}
$$

Stage 2

Decentralized bargaining In the sequel, we shall assume that $\beta > \frac{\gamma^2}{2}$. This assumption guarantees that profit sharing ratios are always positive in equilibrium (see below). When this assumption is violated, the firm–union pair will choose a zero profit sharing ratio during their negotiations, essentially making void the selection of the profit sharing scheme by the firm in the previous stage. Therefore, when $\beta < \frac{\gamma^2}{2}$, the unique equilibrium in stage 1 is universal $\mathcal{FS}$.

Universal $\mathcal{FS}$ Each (F_i, U_i) chooses w_i to maximize its respective generalized asymmetric Nash product. From the focs and exploiting symmetry, we obtain the equilibrium outcome:

$$
\begin{aligned}
w^{\mathcal{DF}} &= w_0 + \frac{\beta(2-\gamma-\gamma^2)\tilde{\alpha}}{4-\gamma(\beta+2\gamma)} \\
L^{\mathcal{DF}} = q^{\mathcal{DF}} &= \frac{(2-\beta)(2-\gamma^2)\tilde{\alpha}}{(2-\gamma)(1+\gamma)[4-\gamma(\beta+2\gamma)]}
\end{aligned}
$$

As under Cournot competition, here too $w^{\mathcal{DF}} > w_0$, $\frac{\partial w^{\mathcal{DF}}}{\partial \beta} > 0$, $\frac{\partial w^{\mathcal{DF}}}{\partial \gamma} < 0$ and $\frac{\partial q^{\mathcal{DF}}}{\partial \beta} < 0$. Yet, $\frac{\partial q^{\mathcal{DF}}}{\partial \gamma} < 0$ only if γ is low enough. Otherwise, output is increasing in γ. As goods become closer substitutes, the fiercer Bertrand competition leads to lower input prices and higher quantities (when γ is not too low).

Universal $\mathcal{PS}$ Each (F_i, U_i) chooses w_i and s_i to maximize its respective generalized asymmetric Nash product. From the focs and exploiting symmetry, we obtain the equilibrium outcome:

$$w^{\mathcal{DP}} = w_0 + \frac{(1-\gamma)\gamma^2\tilde{\alpha}}{4-\gamma(2+\gamma)}, \; s^{\mathcal{DP}} = \frac{2\beta-\gamma^2}{2-\gamma^2}, \; L^{\mathcal{DP}} = q^{\mathcal{DP}} = \frac{(2-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))}$$

Note that: $s^{\mathcal{DP}} < 1$, but $s^{\mathcal{DP}} > 0$ if only if $\beta > \frac{\gamma^2}{2}$. As under Cournot competition, here too $\frac{\partial s^{\mathcal{DP}}}{\partial \beta} > 0$, $\frac{\partial w^{\mathcal{DP}}}{\partial \beta} = 0$, and $\frac{\partial q^{\mathcal{DP}}}{\partial \beta} = 0$. Yet, under Bertrand competition, there is no "subsidization": $w^{\mathcal{DP}} > w_0$. A firm-union pair settles on a relatively high wage rate in order to soften price competition in the product market stage (prices are strategic complements). In addition, $\frac{\partial w^{\mathcal{DP}}}{\partial \gamma} < 0$ and $\frac{\partial q^{\mathcal{DP}}}{\partial \gamma} < 0$ but only if γ is low. The reasoning for the latter is along the lines explained above. Further, $\frac{\partial s^{\mathcal{DP}}}{\partial \gamma} < 0$. As negotiated wages increase with γ (at least, for high enough γ's), these are accompanied by decreasing profit sharing ratios. Finally, it can be readily verified that $w^{\mathcal{DP}} < w^{\mathcal{DF}}$.

Mixed remuneration schemes (F_i, U_i) chooses w_i and s_i and (F_j, U_j) chooses w_j, each to maximize its respective generalized asymmetric Nash product. Solving the system of focs, we obtain the equilibrium outcome:

$$\begin{aligned}
w_i^{\mathcal{DM}} &= w_0 + \frac{(2-\gamma-\gamma^2)\gamma^2[4+\beta\gamma-2\gamma^2]\tilde{\alpha}}{32(1-\gamma^2)+(8-\beta)\gamma^4}, \quad s_i^{\mathcal{DM}} = \frac{2\beta-\gamma^2}{2-\gamma^2} \\
w_j^{\mathcal{DM}} &= w_0 + \frac{\beta(4-\gamma^2)(1-\gamma)[4+(2-\gamma)\gamma]\tilde{\alpha}}{32(1-\gamma^2)+(8-\beta)\gamma^4} \\
q_i^{\mathcal{DM}} &= L_i^{\mathcal{DM}} = \frac{(2+\gamma)(2-\gamma^2)[4+(\beta-2\gamma)\gamma]}{(1+\gamma)[32(1-\gamma^2)+(8-\beta)\gamma^4]} \\
q_j^{\mathcal{DM}} &= L_j^{\mathcal{DM}} = \frac{(2-\beta)(2-\gamma^2)[4+(2-\gamma)\gamma]}{(1+\gamma)[32(1-\gamma^2)+(8-\beta)\gamma^4]}
\end{aligned}$$

Again, $0 < s_i^{\mathcal{DM}} < 1$ as long as $\beta > \frac{\gamma^2}{2}$. As under Cournot competition, $w_i^{\mathcal{DM}} < w_j^{\mathcal{DM}}$. Yet, under Bertrand competition both negotiated wages are above the competitive wage. The intuition for $w_i^{\mathcal{DM}} > w_0$ is along the lines explained above. Moreover, under Bertrand competition, both wages increase in the union's bargaining power; also, although

$\frac{\partial w_j^{\mathcal{DM}}}{\partial \gamma} < 0$, $w_i^{\mathcal{DM}}$ increases in γ whenever the products are close enough substitutes. Finally, as under Cournot competition, here too $\frac{\partial q_i^{\mathcal{DM}}}{\partial \beta} > 0$, and $\frac{\partial q_j^{\mathcal{DM}}}{\partial \gamma} > 0$ for γ high enough; also, $s^{\mathcal{DP}} = s_i^{\mathcal{DM}}$, but in contrast to Cournot competition $w^{\mathcal{DP}} < w_i^{\mathcal{DM}}$.

Coordinated bargaining In the sequel, we shall assume that $\beta > \frac{\gamma^2(2-\gamma+\gamma^2)}{4-2\gamma-\gamma^3+\gamma^4}$. As above, this assumption guarantees that profit sharing ratios are always positive in equilibrium (see below). When this assumption is violated, the unique equilibrium in stage 1 is universal *FS*.

Universal $\mathcal{FS}$ Each (F_i, U_i) chooses w_i and s_i to maximize its Nash product (1.5). From the focs and exploiting symmetry, we obtain the equilibrium outcome:

$$\begin{aligned} w^{\mathcal{CF}} &= w_0 + \frac{\beta(2-\gamma-\gamma^2)\tilde{\alpha}}{4+\gamma(1+\gamma)[(1-\beta)(2-\gamma)\gamma-2]} \\ L^{\mathcal{CF}} = q^{\mathcal{CF}} &= \frac{(4-2\gamma+\gamma^3-\gamma^4+\beta[(1-\gamma)^2\gamma(\gamma+1)-2])\tilde{\alpha}}{(2-\gamma)(1+\gamma)(4+\gamma(1+\gamma)[(1-\beta)(2-\gamma)\gamma-2])} \end{aligned}$$

As under Cournot competition, here too $w^{\mathcal{CF}} > w^{\mathcal{DF}} > w_0$, $\frac{\partial w^{\mathcal{CF}}}{\partial \beta} > 0$, and $\frac{\partial q^{\mathcal{CF}}}{\partial \beta} < 0$. Yet, $\frac{\partial w^{\mathcal{CF}}}{\partial \gamma} < 0$, and $\frac{\partial q^{\mathcal{CF}}}{\partial \gamma} < 0$ only if γ is low enough. Otherwise, output is increasing in γ. Again, as goods become closer substitutes, the fiercer Bertrand competition leads to lower input prices and to higher quantities (when γ is not too low).

Universal $\mathcal{PS}$ Each (F_i, U_i) chooses w_i and s_i to maximize its Nash product (1.7). From the focs and exploiting symmetry, we obtain the equilibrium outcome:

$$\begin{aligned} w^{\mathcal{CP}} &= w_0 + \frac{\gamma[\beta(2-\gamma)[4-\gamma(2-\gamma+\gamma^2)] - \gamma(4-8\gamma+3\gamma^2-\gamma^3)]\tilde{\alpha}}{4(1-\gamma)[4-\gamma^2+\gamma^3+\beta(2-\gamma)(1+\gamma)\gamma]} \\ s^{\mathcal{CP}} &= \frac{2\beta(4-2\gamma-\gamma^3+\gamma^4)-2\gamma^2[2-\gamma+\gamma^2]}{8-\gamma[4+\gamma(3-\gamma)(2-\gamma)-\beta(2-(5-\gamma)\gamma]} \\ L^{\mathcal{CP}} = q^{\mathcal{CP}} &= \frac{[8-4\gamma-6\gamma^2+5\gamma^3-\gamma^4+\beta\gamma^2(2-5\gamma+\gamma^2)]\tilde{\alpha}}{4(1-\gamma^2)[4-\gamma^2+\gamma^3+\beta(2-\gamma)(1+\gamma)\gamma]} \end{aligned}$$

Note that $s^{\mathcal{DP}} < 1$, but $s^{\mathcal{DP}} > 0$ if only if $\beta > \frac{\gamma^2(2-\gamma+\gamma^2)}{4-2\gamma-\gamma^3+\gamma^4}$. As under Cournot competition, here too $\frac{\partial s^{\mathcal{CP}}}{\partial \beta} > 0$, $\frac{\partial w^{\mathcal{CP}}}{\partial \beta} > 0$, and $\frac{\partial q^{\mathcal{CP}}}{\partial \beta} < 0$. Yet, under Bertrand competition, there is never "subsidization": $w^{\mathcal{CP}} > w_0$. In addition, $\frac{\partial s^{\mathcal{CP}}}{\partial \gamma} < 0$, and $\frac{\partial w^{\mathcal{CP}}}{\partial \gamma} < 0$ and $\frac{\partial q^{\mathcal{CP}}}{\partial \gamma} < 0$ for β and γ high enough. As the competitive pressure increases, profit sharing ratios decrease. Finally, note that $w^{\mathcal{CP}} < w^{\mathcal{CF}}$, except if both β and γ are quite large.

Mixed remuneration schemes (F_i, U_i) chooses w_i and s_i and (F_j, U_j) chooses w_j, each to maximize its respective Nash product. Again, w_i is chosen to maximize (F_i, U_i)'s excess joint surplus $js(w_i, w_j) = \pi_i^*(w_i, w_j) + U^*(w_i, w_j) - (w_j - w_0)q^m(w_j)$, with $U^*(w_i, w_j) = (w_i - w_0)q_i^*(w_i, w_j) + (w_j - w_0)q_j^*(w_i, w_j)$, which implies that:

$$w_i(w_j) = \frac{(2-\gamma-\gamma^2)[(a-w_0)\gamma^2 + 4w_0] + 4\gamma w_2}{4(2-\gamma^2)}$$

While s_i is chosen to divide the maximized excess joint surplus $js^*(w_j) = js(w_i(w_j), w_j)$ to the parties according to their respective bargaining powers; hence:

$$s_i(w_j) = \frac{\beta\pi_i^*(w_i(w_j), w_j) - (1-\beta)[U^*(w_i(w_j), w_j) - (w_j - w_0)q^m(w_j)]}{\pi_i^*(w_i(w_j), w_j)}$$

Substituting these expressions into the focs of the (F_j, U_j)' s Nash product, we obtain a fourth degree polynomial of w_j, which can be solved analytically but the resulting relevant root $w_j^{\mathcal{CM}}$ is extremely long and cannot be reported here (it is available upon request). Using $w_j^{\mathcal{CM}}$, we obtain $w_i^{\mathcal{CM}}$, $s_i^{\mathcal{CM}}$, $q_i^{\mathcal{CM}}$, and $q_j^{\mathcal{CM}}$. The latter three, as well as $w_i^{\mathcal{CM}} - w_0$ and $w_j^{\mathcal{CM}} - w_0$, are proportional to $\tilde{\alpha}$, with the coefficient of proportionality being a high degree polynomial in β and γ.[23] It can be checked that $0 < s_i^{\mathcal{CM}} < 1$ for all β, γ. Moreover, as under Cournot competition, $\frac{\partial s_i^{\mathcal{CM}}}{\partial \beta} > 0$, $\frac{\partial s_i^{\mathcal{CM}}}{\partial \gamma} > 0$, $\frac{\partial w_i^{\mathcal{CM}}}{\partial \beta} > 0$, $\frac{\partial w_j^{\mathcal{CM}}}{\partial \beta} > 0$, and $\frac{\partial w_j^{\mathcal{CM}}}{\partial \gamma} > 0$. Further, $\frac{\partial w_i^{\mathcal{CM}}}{\partial \gamma} < 0$ except for low β and low γ. Finally, $w_j^{\mathcal{CM}} > w_0$, and $w_i^{\mathcal{CM}} < w_0$ but only if, given γ, β is high enough.

Turning to stage 1, firms choose simultaneously between $\mathcal{FS}$ and $\mathcal{PS}$. The entries in this

[23]These results have also been confirmed by performing simulations over a fine grid of (β, γ) parameters.

matrix game are as follows. Under universal $\mathcal{FS}$, each firm's profits are $\pi^{k\mathcal{F}} = (1-\gamma^2)(q^{k\mathcal{F}})^2$; under universal $\mathcal{PS}$, they are $\pi^{k\mathcal{P}} = (1-s^{k\mathcal{P}})(1-\gamma^2)(q^{k\mathcal{P}})^2$; and under the mixed configuration, they are: $\pi_i^{k\mathcal{M}} = (1-s_i^{k\mathcal{M}})(1-\gamma^2)(q_i^{k\mathcal{M}})^2$ and $\pi_j^{k\mathcal{M}} = (1-\gamma^2)(q_j^{k\mathcal{M}})^2$, with $k \in \{\mathcal{D}, \mathcal{P}\}$. Substituting the relevant expressions and after cumbersome algebraic manipulations, it can be readily verified that $\pi^{\mathcal{DF}} > \pi_i^{\mathcal{DM}}$ and $\pi^{\mathcal{DP}} < \pi_j^{\mathcal{DM}}$ as long as $\beta > \frac{\gamma^2}{2}$; also, that $\pi^{\mathcal{CF}} > \pi_i^{\mathcal{CM}}$ and $\pi^{\mathcal{CP}} < \pi_j^{\mathcal{CM}}$ as long as $\beta > \frac{\gamma^2(2-\gamma+\gamma^2)}{4-2\gamma-\gamma^3+\gamma^4}$. These imply (i) that a firm offering $\mathcal{FS}$ has no incentives to switch to $\mathcal{PS}$ when its rival offers $\mathcal{FS}$. Thus, universal $\mathcal{FS}$ is always an equilibrium. (ii) a firm offering $\mathcal{PS}$ has always incentives to switch to $\mathcal{FS}$ when its rival offers $\mathcal{PS}$. Thus, universal $\mathcal{PS}$ never arises in equilibrium. (iii) a mixed remuneration scheme regime never arises in equilibrium. Remember that when $\beta < \frac{\gamma^2}{2}$ under decentralized bargaining and $\beta < \frac{\gamma^2(2-\gamma+\gamma^2)}{4-2\gamma-\gamma^3+\gamma^4}$ under coordinated bargaining, the only equilibrium that essentially arises is the universal $\mathcal{FS}$ one. We thus conclude that the unique equilibrium under Bertrand competition is universal $\mathcal{FS}$, independently whether we have decentralized or coordinated bargaining.

Finally, in stage 0, the workers decide whether to form a sector-wide union or two separate unions. It can be checked that $U^{\mathcal{CF}} = 2(w^{\mathcal{CF}} - w_0)q^{\mathcal{CF}} > 2U^{\mathcal{DF}} = 2(w^{\mathcal{DF}} - w_0)q^{\mathcal{DF}}$. As under Cournot competition, the workers, by coordinating their efforts, can attain higher rents in this case too.

1.7.2 A2: Proofs of Propositions

In this subsection of the Appendix, we state the proofs of all the major results presented in this paper.

Proof of Proposition 1.3.1. The equilibrium firms' profits under alternative remuneration schemes and decentralized bargaining are:

$$\pi^{\mathcal{DF}} = \frac{4(2-\beta)^2\tilde{\alpha}^2}{(2+\gamma)^2(4-\beta\gamma)^2}, \quad \pi^{\mathcal{DP}} = \frac{2(1-\beta)(2-\gamma^2)\tilde{\alpha}^2}{[4+(2-\gamma)\gamma]^2}$$
$$\pi_i^{\mathcal{DM}} = \frac{2(1-\beta)(2-\gamma)^2(2-\gamma^2)(4+\beta\gamma)^2\tilde{\alpha}^2}{(32-16\gamma^2+\beta\gamma^4)^2}$$
$$\pi_j^{\mathcal{DM}} = \frac{4(2-\beta)^2(4-\gamma(2+\gamma))^2\tilde{\alpha}^2}{(32-16\gamma^2+\beta\gamma^4)^2}$$

(i) It can be readily verified that $\pi_i^{\mathcal{DM}} \leq \pi^{\mathcal{DF}}$ if and only if $\beta \geq \beta^{\mathcal{DF}}(\gamma)$, with $\frac{d\beta^{\mathcal{DF}}}{d\gamma} > 0$, $\beta^{\mathcal{DF}}(0) = 0$ and $\beta^{\mathcal{DF}}(1) = 0.373$ (Areas I and III of Figure 1.2). Hence, universal $\mathcal{FS}$ is an equilibrium configuration in this case.

(ii) It can be readily verified that $\pi_j^{\mathcal{DM}} \leq \pi^{\mathcal{DP}}$ if and only if $\beta \leq \beta^{\mathcal{DP}}(\gamma)$, with $\frac{d\beta^{\mathcal{DP}}}{d\gamma} > 0$, $\beta^{\mathcal{DP}}(0) = 0$ and $\beta^{\mathcal{DP}}(1) = 0.694$ (Areas II and III of Figure 1.2). Hence, universal $\mathcal{PS}$ is an equilibrium configuration in this case.

(iii) As $\beta^{\mathcal{DF}}(\gamma) < \beta^{\mathcal{DP}}(\gamma)$ for all $\gamma > 0$, both universal $\mathcal{FS}$ and universal $\mathcal{PS}$ are equilibria when $\beta^{\mathcal{DF}}(\gamma) \leq \beta \leq \beta^{\mathcal{DP}}(\gamma)$ (Area III of Figure 1.2). Moreover, it can be checked that $\pi^{\mathcal{DF}} > \pi^{\mathcal{DP}}$ for all (β, γ); hence, the two equilibria can be Pareto-ranked in area III with universal $\mathcal{FS}$ Pareto dominating universal $\mathcal{PS}$.

Proof of Proposition 1.3.2. The equilibrium firms' profits under alternative remuneration schemes and coordinated bargaining are:

$$\pi^{\mathcal{CF}} = \frac{(2-\beta)^2\tilde{\alpha}^2}{4(2+\gamma)^2}, \quad \pi^{\mathcal{CP}} = \frac{(1-\beta)(2-\gamma)^2(4-3\gamma^2)(4-(1-\beta)\gamma^2)\tilde{\alpha}^2}{4(8-\gamma[6\gamma-(2+\gamma)(2\beta+(1-\beta)\gamma^2])^2}$$
$$\pi_i^{\mathcal{CM}} = \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}$$
$$\pi_j^{\mathcal{CM}} = \frac{(2-\beta)^2(2-\gamma)^2[4-(2+\gamma)\gamma^2-\beta\gamma(2-\gamma^2)]^2\tilde{\alpha}^2}{(2-\gamma^2)^2[16-2\gamma^2(2-\beta+\beta^2)+(1-\beta)^2\gamma^4]^2}$$

(i) It can be readily verified that $\pi_i^{\mathcal{CM}} \leq \pi^{\mathcal{CF}}$ if and only if $\beta \geq \beta^{\mathcal{CF}}(\gamma)$, with $\frac{d\beta^{\mathcal{CF}}}{d\gamma} > 0$,

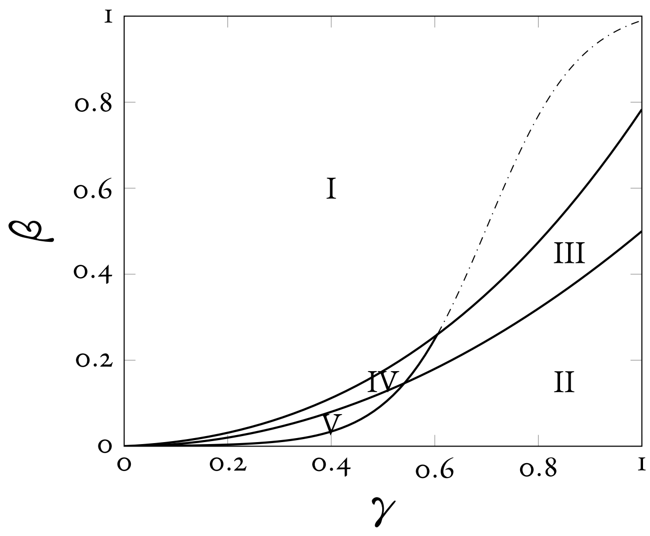


Figure 1.4: Superimpose of the equilibrium areas under decentralized and coordinated bargaining.

$\beta^{\mathcal{CF}}(0) = 0$ and $\beta^{\mathcal{CF}}(1) = 0.5$ (Areas I and III of Figure 1.3). Hence, universal $\mathcal{FS}$ is an equilibrium configuration in this case.

(ii) It can be readily verified that $\pi_j^{\mathcal{CM}} \leq \pi^{\mathcal{CF}}$ if and only if $\beta \geq \beta^{\mathcal{CP}}(\gamma)$, with $\frac{d\beta^{\mathcal{CP}}}{d\gamma} > 0$, $\beta^{\mathcal{CP}}(0) = 0$ and $\beta^{\mathcal{CP}}(1) = 1$ (Areas II and III of Figure 1.3). Hence, universal $\mathcal{PS}$ is an equilibrium configuration in this case.

(iv) As $\beta^{\mathcal{CF}}(\gamma) < \beta^{\mathcal{CP}}(\gamma)$ for all $\gamma > 0.6208$, both universal $\mathcal{FS}$ and universal $\mathcal{PS}$ are equilibria when $\beta^{\mathcal{CF}}(\gamma) \leq \beta \leq \beta^{\mathcal{CP}}(\gamma)$ (Area III of Figure 1.3). Moreover, it can be checked that $\pi^{\mathcal{CF}} > \pi^{\mathcal{CP}}$ for all (β, γ); hence, the two equilibria can be Pareto-ranked in area III with universal $\mathcal{FS}$ Pareto dominating universal $\mathcal{PS}$.

(iv) It can be readily verified that for all $\gamma \leq 0.6208$ and $\beta^{\mathcal{CP}}(\gamma) < \beta^{\mathcal{CF}}(\gamma)$, we have $\pi^{\mathcal{CF}} \leq \pi_i^{\mathcal{CM}}$ *and* $\pi^{\mathcal{CP}} \leq \pi_j^{\mathcal{CM}}$. Hence, a mixed remuneration scheme is the equilibrium configuration (Area IV of Figure 1.3).

Proof of Proposition 1.3.3. Assuming that workers believe that their firms will coordinate on the Pareto superior equilibrium each time and superimposing Figures 1.2 and 1.3, we obtain five (γ, β)–areas as shown in Figure 1.4.

Substituting (1.4), (1.8), (1.11), (1.6), (1.12) and (1.13) into (1.1) and (1.2), we obtain the equilibrium unions' rents under alternative configurations of remuneration schemes. We then compare the relevant expressions for each (γ, β)–area. In particular,

Area I: Under both decentralized and coordinated bargaining, both firms choose $\mathcal{FS}$. It can be readily verified that $U_i^{\mathcal{DF}} + U_j^{\mathcal{DF}} < U^{\mathcal{CF}}$.

Area II: Under both decentralized and coordinated bargaining, both firms choose $\mathcal{PS}$. It can be readily verified that $U_i^{\mathcal{DP}} + U_j^{\mathcal{DP}} < U^{\mathcal{CP}}$.

Area III: Under decentralized (coordinated) bargaining both firms choose $\mathcal{FS}$ ($\mathcal{PS}$). It can be readily verified that $U_i^{\mathcal{DF}} + U_j^{\mathcal{DF}} < U^{\mathcal{CP}}$.

Area IV: Under decentralized bargaining, both firms choose $\mathcal{FS}$. While under coordinated bargaining, a mixed remuneration scheme configuration arises. It can be readily verified that $U_i^{\mathcal{DF}} + U_j^{\mathcal{DF}} < U^{\mathcal{CM}}$.

Area V: Under decentralized bargaining, both firms choose $\mathcal{PS}$. While under coordinated bargaining, a mixed remuneration scheme configuration arises. It can be readily verified that $U_i^{\mathcal{DP}} + U_j^{\mathcal{DP}} < U^{\mathcal{CM}}$.

In summary, in all (β, γ)–areas, workers rents are higher under coordinated than under decentralized bargaining; hence, workers have incentives to coordinate their efforts forming a sector–wide union.

Proof of Proposition 1.4.1. Substituting (1.4), (1.8), (1.11), (1.6), (1.12) and (1.13) into $CS(q_i, q_j) = \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$, we obtain the consumers' surplus under alternative remuneration schemes and modes of bargaining. Further, using the relevant expressions for the firms' profits and the unions' rents (see above), we obtain the respective expressions for social welfare.

(ii) It can be readily verified that $\forall \beta, \gamma \in (0, 1)$ the following inequalities hold for consumer surplus: $CS^{\mathcal{DP}} > CS^{\mathcal{CP}}$, $CS^{\mathcal{DF}} > CS^{\mathcal{CF}}$, and $CS^{\mathcal{DM}} > CS^{\mathcal{CM}}$; moreover, the same inequalities hold for social welfare: $SW^{\mathcal{DP}} > SW^{\mathcal{CP}}$, $SW^{\mathcal{DF}} > SW^{\mathcal{CF}}$, and $SW^{\mathcal{DM}} > SW^{\mathcal{CM}}$.

(iii) It can be readily verified that $\forall \beta, \gamma \in (0, 1)$ the following inequalities hold for consumers surplus and social welfare: $CS^{\mathcal{DP}} > CS^{\mathcal{DM}} > CS^{\mathcal{DF}}$, and $SW^{\mathcal{DP}} > SW^{\mathcal{DM}} > SW^{\mathcal{DF}}$.

(iv) It can be readily verified that $CS^{\mathcal{CP}} > CS^{\mathcal{CF}}$ and $SW^{\mathcal{CP}} > SW^{\mathcal{CF}}$ except if $\gamma > 0.828$ and $\beta > \beta_W(\gamma)$, with $\frac{d\beta_W}{d\gamma} > 0$, $\beta_W(0.828) = 0$, and $\beta_W(1) = 0.333$.

(i) From (ii) and (iii) we get that $CS^{\mathcal{DP}}$ and $SW^{\mathcal{DP}}$ are the highest levels of consumers surplus and social welfare.

2

Disclosure Regime and Bargaining in Vertical Markets

2.1 Introduction

Vertical contracts in which one or more of the parties to the agreement possesses market power on the relevant market, give rise to competition concerns (Office of Fair Trading, 2004). The process of vertical contracting refers not only to the very trading terms of the vertical contracts but to the whole process of the determination of the contract terms. The various contractual provisions, broadly characterized as *vertical restraints*,[1] could produce both pro– and anti–competitive effects (Rey, 2012). Vertical restraints attract much attention due to their effect on the competition. Two important and negative effects of vertical restraints are the competition softening between some parties of the agreement and/or the facilitation of downstream collusion through the manipulation of prices. The latter, in turn, could cause negative effects in the competition and can harm consumers (European Commission, 2010). One could argue why the disclosure regime of the vertical contract terms is not part of these vertical restraints? As we will show, the disclosure regime could be used to manipulate downstream competition. The contract terms of the vertical agreements are of paramount importance, but nevertheless, the disclosure regime of these terms could, also, play a vital role in the competition process (Arya and Mittendorf, 2011).

The motivation of this research is the ongoing debate over the vertical contract disclosure regime. Assume a two-tier vertical industry, with some upstream suppliers supplying a crucial spare part to some downstream retailers through vertical contracts. Some researchers believe that each retailer is not confident about the rival contract terms, and thus the rival costs, when it comes to deciding its own output.[2] This might be because (a)each retailer fears that its rivals could receive secret deals from the suppliers, (b)the rival contract terms are too complex to follow, (c)it is impossible to verify contracts at court, or (d)the suppliers tend to renegotiate often.[3] This *secrecy* of rival contract terms leads the retailers to be unable to react optimally,

[1]Vertical restraints are contractual provisions such as terms of payment (two–part tariffs), limiting one party's decisions (resale price maintenance) or softening competition (exclusive territory) (Rey and Verge, 2008). We argue here that the disclosure regime could be part of these vertical restraints.

[2]Katz (1991); O'Brien and Shaffer (1992); McAfee and Schwartz (1994, 1995); Rey and Verge (2004); Rey and Tirole (2006); Rey and Verge (2008); Arya and Mittendorf (2011).

[3]Knowing the number of rival costs but not the rule in which this is calculated does not change the disclosure regime. Katz (1991) mentions an illustrative example: in the US, the Securities and Exchange Commission requires firms to announce the amount of managerial compensation, but not the rule in which this compensation is calculated. Thus, any potential investor (upstream supplier of money) could not evaluate what the agent's incentives are.

and force them to form *beliefs* about rival contract terms.[4,5] Others believe that each retailer can fully *observe* and verify rival terms before it makes its output decision, and contract terms are not subject to renegotiation.[6] In this vivid debate, we answer by endogenizing the vertical contract's disclosure regime and letting the firms to decide which regime is optimal, based on the specificities of the industry at hand.

In the past few decades, regulators all over the world demand for extra disclosure in the contract terms, but its efficacy is unclear (Marotta-Wugler, 2012). A question spontaneously arises: is the demand for more disclosure in the right direction? In this paper we show that the disclosure regime of the vertical contracts can be a game–changer; it can be used by market participants to soften product market competition and has significant effects on the social welfare. Furthermore, we prove that when firms compete in quantities (resp. prices) a policymaker could increase social welfare by encouraging (resp. discouraging) the disclosure of the vertical contract's terms, no matter the type of the contract (linear or two–part tariffs), and the structure of the upstream market (single common or separate dedicated supplier). In particular, this paper addresses the following research questions.

First, can the bargaining process and the intensity of the competition (as described by the product's horizontal differentiation) soften the anti-competitive effects of the vertical restraints? Marx and Shaffer (2007) show that when the suppliers have high bargain power, they

[4]The situation in which the accepted vertical contracts cannot be seen by both retailers before their output decisions has been made, are labeled with many verbally different, but equivalent terms like: *secrecy* (McAfee and Schwartz, 1994; Rey and Tirole, 2006; Rey and Verge, 2008), *(interim) unobservability* (Katz, 1991; Rey and Verge, 2004), or *confidentiality* (Arya and Mittendorf, 2011; Liu and Wang, 2014). In our analysis, we use all three terms interchangeably, but we prefer the second term.

[5]Among many, the relevant literature highlights three types of beliefs: symmetric, passive and wary beliefs. Symmetric beliefs state that retailers treat unexpected off-equilibrium offers from suppliers as perfectly correlated with the offers made to their rivals. Thus, each retailer believes that his rivals receive the same off-equilibrium offer as he does. Passive beliefs state that no matter what off-equilibrium offer is received by the retailer, he believes that the rivals have reached an equilibrium. Thus, the offers he receives are uncorrelated with the rival offers. Both symmetry and passive beliefs view off-equilibrium offers as trembles by the suppliers. On the contrary, under wary beliefs, retailers believe that any off-equilibrium offer is a deliberate choice: even if the offers are off-equilibrium, they are optimal given the rival offers. (McAfee and Schwartz, 1994).

[6]Rey and Stiglitz (1988); Katz (1988); Horn and Wolinsky (1988); Chen (2001); de Fontenay and Gans (2005); Milliou and Petrakis (2007); Marx and Shaffer (2007). Katz (1991) provides a list with several authors using observable contracts and a useful discussion.

tend to exclude the weaker retailers, and thus effectively softening downstream competition. In a different setup, Shaffer (2005) shows that competitive suppliers could offer wholesale prices above the marginal cost in order to soften downstream competition and maintain high prices on the retail market. Arya and Mittendorf (2011) show that when suppliers maximize the vertical chain's profits, wholesale price under observable contracts is above marginal cost. We argue that when suppliers bargain with retailers, wholesale price is below marginal cost. Furthermore, the product's substitutability acts as a bargain power's substitute: as products become more homogeneous, the supplier could use the fixed fee to extract more downstream profits without changing his bargain power.

Second, which are the different anti-competitive effects between the linear and the non-linear contracts (in particular: two-part tariffs) in the same setup? The related literature offers papers with either non-linear contracts (Arya and Mittendorf, 2011) or papers with linear tariffs (Liu and Wang, 2014), but there is no single paper to address both under the same assumptions and timing. Literature has shown that non-linear contracts such as the two-part tariffs could enhance coordination and lead to joint-profit maximization, while linear contracts could create negative vertical externalities (Rey, 2012), but in this paper, we are interested in showing how the contract type could affect the disclosure regime decision and change the possible disclosure equilibria. We show that in contrast to two-part tariffs in which we encounter multiple disclosure equilibria, under linear contracts we encounter a single disclosure equilibrium.

To address our research questions, we consider a two-tier vertical market, consisting of a single common upstream supplier of a differentiated good, and a downstream Cournot duopoly, forming a bottleneck with two vertical chains. In a pre-stage, upstream and downstream firms decide simultaneously whether to publicly announce or kept secret the vertical contract terms. For a contract to remain secret, both parties of the vertical chain must keep the contract terms secret. For a contract to become observable, at least one party of the vertical chain must publicly announce the contract terms. In the first stage, the members of the vertical chain bargain over the contract terms, while in the second stage the downstream retailers compete a la Cournot in the differentiated product market.[7]

This paper fits on the broader literature of vertical contracting, and if we wish to be more precise, to the information sharing in vertical structures. The main issue of this literature is the commitment problem an upstream monopolist faces when it comes to trade with multiple downstream retailers who compete in the product market (Horn and Wolinsky, 1988; O'Brien and Shaffer, 1992; McAfee and Schwartz, 1994, 1995; Rey and Verge, 2004; Milliou and Petrakis, 2007). However, none of these papers (or any other paper from the literature) consider the optimal choice of the vertical contract terms disclosure regime. Our paper undertakes his task and highlights the important differences between the two disclosure regimes (secrecy versus observability), as well as the paramount importance of the latter to the upstream monopolist's commitment problem.

Two papers that are related to ours are Arya and Mittendorf (2011) and Liu and Wang (2014). Arya and Mittendorf (2011) use a two-tier vertical set-up, with Cournot competition downstream over a homogeneous product, while the upstream firm unilaterally decides the wholesale price. The disclosure regime is set exogenously. We depart from Arya and Mittendorf (2011) in three important points: (a)we endogenize the disclosure regime decision, by adding a pre-stage in the game, in which all the parties of the agreement decide simultaneously over the disclosure regime that maximizes their profits, (b)we let the parties to the agreement to bargain over the contract terms, (c)we extend the analysis by allowing for (horizontal) product differentiation and by characterizing the equilibrium when firms use linear contracts.

In a similar vain Liu and Wang (2014) use a two-tier vertical model with differentiated Cournot competition downstream and linear contracts. The differences with our model are the following: (i)they allow for linear contracts only, (ii)they set the supplier(s) to decide over the disclosure regime, and (iii)there is no bargain. None of these papers explores the role of the retailers' bargain power because both set the supplier(s) to unilaterally set wholesale prices.

[7]The solution concept used here is the "Nash–in–Nash"solution concept: Nash bargain problems within a Nash equilibrium (Rey and Verge, 2017; Collard-Wexler et al., 2017). As Rey and Verge (2004) state, the "Nash–in–Nash"solution concept is somewhat implicitly related to passive beliefs.

Both papers account for a single common and for two dedicated upstream suppliers, while Arya and Mittendorf (2011) accounts also for price competition in the product market.

We also contribute to the literature on vertical foreclosure. Hart and Tirole (1990) show that under secret contracting, exclusive arrangements can help an upstream monopolist to re–establish his market power. Rey and Tirole (2006) provide an excellent analysis of vertical foreclosure, featuring the anticompetitive motives for upstream firms to use exclusive secret arrangements in order to foreclose downstream retailers. In line with this strand of the literature, in this paper we show that an upstream monopolist could use the disclosure regime to re–establish his market power, increasing his profits and softening downstream competition.

Even though this paper concentrates on Industrial Organization literature and applications, the results are also valid under a Labour Economics narration: a single industry–wide worker's union supplying two downstream firms with labor. Firms and union bargain using two-part tariffs over the (upfront lump-sum) human capital investments and the monthly wages. The question here is whether the observability of the rival contract terms could alter firm's incentives to pay higher wages or to invest more money in human capital.[8]

The rest of the paper is structured as follows. In Section 3.2 we describe the model structure, the sequence of the events and the bargaining framework. In Section 2.3 we characterize the equilibrium outcomes under different disclosure regimes and determine the equilibrium regime. In Section 3.5 we conduct welfare analysis and some comparative statics. In Section 2.5 we extend our analysis by assuming Bertrand competition in the product market, or bargain over linear wholesale contracts, or dedicated exclusive suppliers. Finally, Section 3.7 offers the concluding remarks. The paper ends with the References, and the Appendix, in which all proofs are relegated.

[8]A wide literature review made by Hansson et al. (2004) shows that human capital investments affect employees' performance and firms' profitability (and not the other way around). Furthermore, human capital investments could increase firms; innovative capacity, a crucial factor in the IT sector. Finally, if we consider an environment of a single union having representatives bargaining simultaneously and separately with each firm, then an interim unobservable regime is more than possible.

2.2 The Model

2.2.1 Market structure and disclosure regimes

Consider a two-tier vertical industry, consisting of a single common upstream manufacturer $\mathcal{M}$, and two rival downstream retailers, namely $\mathcal{R}_i$ and $\mathcal{R}_j$.[9] $\mathcal{M}$ produces a differentiated good, at a constant unit cost $c > 0$. This good is sold to the retailers through non-linear two-part tariffs vertical contracts, consisting of a (consumption independent) fixed fee F_i and a (per unit) wholesale price w_i. Contract terms are bargained separately and simultaneously between $\mathcal{M}$, and each $\mathcal{R}_i$. The latter sells quantity q_i at a retail price p_i. $\mathcal{R}_i$ faces a constant unit cost k_i, which for simplicity is set equal to zero. $\mathcal{R}_i$'s only cost is the cost induced by the two-part tariff vertical contract. Both retailers face a linear inverse demand function $p_i(q_i, q_j) = \alpha - q_i - \gamma q_j$, where $c < \alpha$ and $0 < \gamma < 1$ (products are imperfect substitutes).[10]

In the pre-stage, firms decide their disclosure regime. Following the literature (Arya and Mittendorf, 2011; Liu and Wang, 2014), we consider two possible disclosure regimes:

(a)*Interim observability:* the contract terms agreed by the bargain pair $(\mathcal{R}_i, \mathcal{M})$ can be observed by the rival $\mathcal{R}_j$ just after the successful end of the bargains. For a contract to become interim observable, at least one member of the bargain pair should announce them.[11]

(b)*Interim unobservability:* the contract terms agreed by the bargain pair $(\mathcal{R}_i, \mathcal{M})$ cannot be observed by the rival $\mathcal{R}_j$ in the time interval between the successful end of the bargains and the completion of the product market competition. For a contract to remain interim unobservable, both members of the bargain pair should keep the contract terms secret.[12]

[9] The analysis could be readily extended to situations with $n > 2$ retailers. Considering only two retailers makes the analysis more tractable.

[10] Following Singh and Vives (1984), we consider a unit mass of identical consumers, each having the same quadratic utility function $u(q_i, q_j) = \alpha(q_i + q_j) - \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$. Higher $\gamma \in (0, 1)$ indicates more homogeneous products.

[11] As stated in Rey and Verge (2004), in interim observability, contract terms remain secret up until the moment the final contract is signed. Therefore, acceptance decisions are based on beliefs. In what follows, we assume passive beliefs: retailers' do not revise their beliefs about the offers made to rivals when receiving an out-of-equilibrium offer.

[12] Consider the example of two bargain parties deciding over to sign or not a non–disclosure agreement (NDA). For the NDA to be valid, both parties must sign it. If at least one party decides not to sign it, then there is no legal restriction to disclose the trading terms of the agreement. If one party

Each retailer is aware of its own contract terms, but whether or not he is aware of its rival's contract terms depends on the disclosure regime in place. Notice that in the interim unobservability regime, each retailer does not observe either the out-of-equilibrium contract offers during the bargaining process nor the ultimate equilibrium bargaining outcome (Arya and Mittendorf, 2011).[13]

2.2.2 Sequence of events and bargaining framework

The sequence of events is summarized in Figure 3.1. Firms play a 2-stage game, with a pre-stage attached. Game timing reflects the idea that the long-run decisions, such as the disclosure regime decision, may have considerable effects on the short-run decisions, such as the output decision.

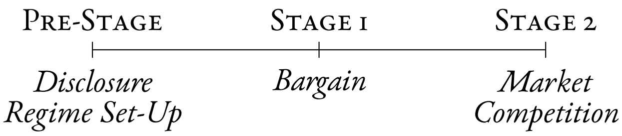


Figure 2.1: Timing of the Game

Pre-stage: Disclosure regime set-up stage. Each firm decides simultaneously and separately over the disclosure regime that maximizes firm's profits. Firms have to choose between: (i)disclosing the trading terms of the deal (equivalently, not signing a non–disclosure agreement), which in our setup is labeled as *interim observability*, and (ii)not disclosing the contract terms (equivalently, signing a non–disclosure agreement) which in our setup is labeled as *interim unobservability*.

Stage 1: Bargaining stage. $\mathcal{M}$ bargains simultaneously and separately with either $\mathcal{R}_i$ or $\mathcal{R}_j$, over a two-part tariff contract (w_i, F_i) or (w_j, F_j).[14] To model the bargaining stage, we

violates the NDA then it can be brought to court and be penalized.

[13]An alternative timing of the game, which can favor deviation, is mentioned in McAfee and Schwartz (1994): downstream firm first pays the fixed fee F_i under secret contract and before the determination of the wholesale price w_i, rival's contract could become observable (ex–post observability). Under this game framework, timing favors deviation because it can affect upstream firm's profitability and downstream firm's total cost.

[14]The simultaneous and separate bargains is standard in situations with multilateral contracting

use the generalized asymmetric Nash bargaining product (Milliou and Petrakis, 2007). $\mathcal{M}$ has bargain power $0 < \beta < 1$ while each $\mathcal{R}_i, \mathcal{R}_j$ have bargain power $1 - \beta$. Due to the multiplicity of beliefs retailers form when they receive an out-of-equilibrium offer, multiple equilibria could arise. To remedy this situation, we obtain a unique equilibrium by imposing *pairwise proofness* on the equilibrium contracts. Pairwise proofness is closely related to *passive beliefs*.[15] An additional assumption, common in the aforementioned literature, is that the contract terms of one pair are *non-contingent* of any disagreements of the rival pair. This assumption captures nicely the idea that bargaining parties cannot commit to a permanent and irrevocable breakdown in their negotiations.[16]

Stage 2: Market competition stage. The two rival downstream retailers compete a la Cournot in the product market. To solve this dynamic multi-stage game we evoke the *Nash-in-Nash* solution concept: the Cournot-Nash equilibrium (the non-cooperative solution of stage 2) of the asymmetric generalized Nash bargaining solution (the cooperative solution of stage 1) (Rey and Verge, 2017; Collard-Wexler et al., 2017). We also assume that the negotiated outcome of a bargaining pair is non-contingent on whether the rival pair has reached or not an agreement. In other words, we impose the negotiated agreement between $(\mathcal{R}_i, \mathcal{M})$ to be immune to a bilateral deviation of the rival's agreement.

As we will explain in more detail later, the bargaining parties commit to a specific disclosure regime for two reasons. First, from the moment the disclosure regime is setup until the

e.g. Horn and Wolinsky (1988); Milliou and Petrakis (2007); Rey and Verge (2004). It captures the fact that each bargaining pair has incentives to behave opportunistically. The rationale behind this assumption could be that the manufacturer has two representatives, each negotiating at the same time with a different retailer.

[15]Passive beliefs and pairwise proofness go hand in hand and are appropriate when we perceive the generalized asymmetric Nash bargaining solution as the limit equilibrium of an alternating offers-counter-offers non-cooperative bargaining game (Binmore et al., 1986). In that case, passive beliefs state that $\mathcal{R}_i$ will handle any out-of-equilibrium offer from $\mathcal{M}$ as a "tremble", uncorrelated with any offer from $\mathcal{M}$ to $\mathcal{R}_j$. $\mathcal{R}_i$ believes that under any offer received from $\mathcal{M}$, the pair $(\mathcal{M}, \mathcal{R}_j)$ has reached an equilibrium outcome. This solution concept is used widely in the relevant literature. Note that different beliefs (e.g. wary beliefs) lead to other equilibrium outcomes, but in some cases are intractable (Hart and Tirole, 1990; McAfee and Schwartz, 1994).

[16]Non-contingency states that it is common knowledge that any breakdown in the negotiations between $(\mathcal{R}_i, \mathcal{M})$ is non-permanent and non-irrevocable (Horn and Wolinsky, 1988). In other words, in case of a breakdown in the bargain of $(\mathcal{R}_i, \mathcal{M})$, then $(\mathcal{R}_j, \mathcal{M})$ will not renegotiate their contract terms (Milliou and Petrakis, 2007).

moment the contract is signed, it is considered as a pre-contractual arrangement, and as such is no "cheap talk". In most countries, the US and continental Europe included, if brought in a court it might be considered as binding (Schwartz and Scott, 2007). Second, after the exact moment contracts are signed, the disclosure regime is of minor importance. The retailer will choose his output based on the contract terms signed, even if the disclosure regime has changed. An implicit assumption made here is that there are no renegotiations between stages 2 and 3. A possible change in the disclosure regime with no renegotiations will not change equilibrium output, as we will mathematically show later on. In case of renegotiations, all three market participants will find themselves back to the stage 0, deciding the disclosure regime, as a pre–contractual arrangement.

Our notational convention is as follows. Superscript $\mathcal{O}$ denotes observability of vertical contract terms, while $\mathcal{S}$ denotes secrecy (or interim unobservability). Superscript $\mathcal{X}$ denotes the mixed case, in which one firm bargain under interim observability while the other firm bargain under interim unobservability (secrecy).

2.3 Equilibrium results

In order to set the pre-stage, in which the disclosure regime is decided, we have to characterize the equilibrium outcomes under all possible disclosure regimes. We consider the following three: (a)the *universal interim observability* regime, (b)the *interim unobservability* regime, as well as (c)the *mixed regime* in which one firm is under interim observability while the other firm is under interim unobservability.

2.3.1 Universal Interim Observability Regime

Under interim observability, both firms observe rival contract terms just after the successful ending of the stage 2 bargains. $\mathcal{R}_i$ chooses q_i in order to maximize its net profits: $\pi_i(q_i, q_j) = (\alpha - q_i - \gamma q_j - w_i)q_i - F_i$. The first order condition (foc) gives rise to the following reaction function:

$$q_i(w_i, q_j) = \frac{1}{2}(\alpha - w_i - \gamma q_j)$$

A decrease in w_i moves q_i upwards, making $\mathcal{R}_i$ a more aggressive competitor in the product market. Solving the system of reaction functions we get:

$$q_i^{\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma) - 2w_i + \gamma w_j}{4-\gamma^2}$$
$$\pi_i^{\mathcal{O}}(w_i, w_j, F_i) = [q_i^{\mathcal{O}}(w_i, w_j)]^2 - F_i^{\mathcal{O}}$$

In stage 1, the retailers-manufacturer vertical chains bargain simultaneously and separately over its specific two-part tariff contract. If $\mathcal{R}_i$ fails to reach an agreement with $\mathcal{F}_i$, then it can still extract some economic rents from selling products to the rival retailer $\mathcal{F}_j$. By doing so, $\mathcal{F}_j$ becomes a monopolist in the product market, thus its output equals $q_j^m(w_j) = \frac{1}{2}(a - w_j)$. Hence, $\mathcal{R}_i$'s disagreement payoff is $(w_j - c)q_j^m(w_j) + F_j$. Having that in mind, the vertical chain $(\mathcal{M}, \mathcal{R}_i)$ chooses (w_i, F_i) to maximize the following generalized asymmetric Nash bargain product:

$$\mathcal{N}_i^{\mathcal{O}}(w_i, w_j, F_i) = [\pi_i^{\mathcal{O}}(w_i, w_j, F_i)]^{1-\beta}[\Pi^{\mathcal{O}}(w_i, w_j, F_i, F_j) - (w_j - c)q_j^m(w_j) - F_j]^{\beta}$$

where

$$\Pi^{\mathcal{O}}(w_i, w_j, F_i, F_j) = \sum_{i=1}^{2}[(w_i - c)q_i^{\mathcal{O}}(w_i, w_j) + F_i]$$

are $\mathcal{M}$'s aggregate net profits. Following O'Brien and Shaffer (1992), we maximize Nash product into two steps: (a)we use w_i to maximize joint surplus, and (b)we use F_i to distribute the joint surplus between the bargaining parties, according to their bargain power. By invoking the equilibrium symmetry, we get:

$$w^{\mathcal{O}} = c - \frac{\gamma^2\tilde{\alpha}}{2(2+\gamma^2)}, \quad q^{\mathcal{O}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}, \quad p^{\mathcal{O}} = \alpha - \frac{(1+\gamma)(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}$$

where: $\tilde{\alpha} = \alpha - c > 0$. The following Lemma summarizes.

Lemma 7. *Under Cournot competition downstream, interim observable contracts, two-part tariffs, and linear demand:*

1. *Wholesale price is below marginal cost, is bargain power independent, and it decreases as products become more homogeneous* $\frac{\partial w^{\mathcal{O}}}{\partial \gamma} < 0$.

2. *Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous* $\frac{\partial q^{\mathcal{O}}}{\partial \gamma} < 0 \Leftrightarrow \gamma < 0.58$, *while* $\frac{\partial p^{\mathcal{O}}}{\partial \gamma} < 0$.

3. *Fixed fee increases as the manufacturer's bargain power increases* $\frac{\partial F^{\mathcal{O}}}{\partial \beta} > 0$, *while* $\frac{\partial F^{\mathcal{O}}}{\partial \gamma} > 0 \Leftrightarrow \beta > \beta^{\mathcal{O}}_{crit}(\gamma) = \frac{\gamma(2+\gamma^2-2\gamma)}{(1-\gamma)(2-\gamma^2)}$.

The intuition behind this Lemma is straightforward: a stronger manufacturer ($\beta \uparrow$) will negotiate for more fixed fee, but it will not increase wholesale price, knowing that this will create fewer profits for the retailers, and thus less fixed fee for him ($\mathcal{M}$ is treating downstream competition as inter-brand). On the other hand, a lower product differentiation ($\gamma \uparrow$) has mixed effects on both the quantity and the fixed fee.

The fact that the wholesale price is below marginal cost reflect a subsidy from the upstream supplier to the downstream retailers. This behavior is known to the strategic delegation literature (Vickers, 1985; Sklivas, 1987). A price below marginal cost leads to higher output and thus higher profits for the downstream retailer. Then the upstream supplier uses the fixed fee to extract the portion of the joint surplus his bargain power reflects, and to compensate for the wholesale price loses. Notice that $\frac{\partial w^{\mathcal{O}}}{\partial \gamma} < 0$ and $\frac{\partial F^{\mathcal{O}}}{\partial \gamma} > 0$ show that the amount of the subsidy increases with the degree of product substitutability, and thus the upstream supplier is willing to accept a lower compensation via the fixed fee.

2.3.2 Universal Interim Unobservability Regime

Under interim unobservability, $\mathcal{R}_i$ is unable to observe the contract terms $(\tilde{w}_j, \tilde{F}_j)$ agreed by the vertical chain $(\mathcal{R}_j, \mathcal{M})$ before he makes his output choice, thus he is unable to calculate $\tilde{q}_j = \frac{1}{2}(\alpha - \tilde{w}_j - \gamma\tilde{q}_i)$, which is treated as a constant parameter (Arya and Mittendorf, 2011;

Liu and Wang, 2014).[17] The first order condition produce the following equilibrium:

$$q_i^{\mathcal{S}}(w_i;\tilde{q}_j) = \frac{1}{2}(\alpha - w_i - \gamma\tilde{q}_j)$$
$$\pi_i^{\mathcal{S}}(w_i, F_i;\tilde{q}_j) = [q_i^{\mathcal{S}}(w_i;\tilde{q}_j)]^2 - F_i^{\mathcal{S}}$$

Intuitively, $\mathcal{R}_i$ knows that his rival plays a Cournot game, thus he is able to formulate his equilibrium output, but he is unable to replace $\tilde{w}_j$ with a credible equilibrium value. Furthermore, $\mathcal{R}_i$ knows that $\mathcal{R}_j$ faces the same unobservability problem, and thus $\mathcal{R}_j$ has to form a belief about $\tilde{q}_i$. Consequently, $\mathcal{R}_i$ acts as a monopolist over the residual demand: $q_i^{\mathcal{S}}(w_i) = \frac{1}{2}(A - w_i)$ where $A = \alpha - \gamma\tilde{q}_j$.

Moving to Stage 1, we choose (w_i, F_i) to maximize the following generalized asymmetric Nash bargain product:

$$\mathcal{N}_i^{\mathcal{S}}(w_i, w_j, F_i;\tilde{q}_j) = [\pi_i^{\mathcal{S}}(w_i, F_i;\tilde{q}_j)]^{1-\beta}[\Pi^{\mathcal{S}}(w_i, w_j, F_i, F_j;\tilde{q}_j) - (w_j - c)q_j^m(w_j) - F_j]^{\beta}$$

where:

$$\Pi^{\mathcal{S}}(w_i, w_j, F_i, F_j;\tilde{q}_j) = (w_i - c)q_i^{\mathcal{S}}(w_i;\tilde{q}_j) + (w_j - c)\tilde{q}_j + F_i + F_j$$

are $\mathcal{M}$'s aggregate net profits. By obtaining the foc's of the rival vertical chain $(\mathcal{R}_j, \mathcal{M})$, and knowing that, in equilibrium, beliefs are correct (Liu and Wang, 2014), we get:

$$w^{\mathcal{S}} = c, \quad q^{\mathcal{S}} = \frac{\tilde{\alpha}}{2+\gamma}, \quad p^{\mathcal{S}} = \alpha - \frac{(1+\gamma)\tilde{\alpha}}{2+\gamma}$$

The following Lemma summarizes.

[17] Based on Brandenburger and Dekel (1993), $\tilde{w}_j$ is the level 1 belief $\mathcal{R}_i$ has to form for $\mathcal{R}_j$'s wholesale price, while $\tilde{q}_i$ is the level 2 belief $\mathcal{R}_i$ has to form for $\mathcal{R}_j$'s belief over $\mathcal{R}_i$'s equilibrium output. Level 0 beliefs (common knowledge to both retailers) are: (1)the existence of a single common upstream supplier, (2)the Cournot duopoly in the product market, (3)the mutual unobservability, and (4)the use of two-part tariff contracts. Thus, as stated in Rey and Verge (2004), q_i depends on $\mathcal{R}_i$'s belief about $\tilde{q}_j$, and not the actual q_j.

Lemma 8. *Under Cournot competition downstream, interim unobservable contracts, two-part tariffs, and linear demand:*

1. *Wholesale price is equal to marginal cost, and thus it is independent of the manufacturer's brgain power and the market features (such as product differentiation).*
2. *Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous* $\frac{\partial q^S}{\partial \gamma} < 0$ *and* $\frac{\partial p^S}{\partial \gamma} < 0$.
3. *Fixed fee increases with bargain power* $\frac{\partial F^S}{\partial \beta} > 0$*, and decreases as products become more homogeneous* $\frac{\partial F^S}{\partial \gamma} < 0$.

Wholesale price is free of any beliefs or market features, and becomes a dominant strategy for the manufacturer. The fact that each retailer cannot observe rival's contract terms, pushes wholesale price in higher levels. Thus, information structure plays a crucial role in vertical contracts. The common upstream manufacturer has maximum profits when product's substitutability is zero. The same holds true for the retailers' profits.

2.3.3 Mixed Regime

Under the mixed regime, and without any loss of generality let assume that $\mathcal{M}$ bargains with $\mathcal{R}_j$ under interim unobservability, while $\mathcal{M}$ bargains with $\mathcal{R}_i$ under interim observability.

In Stage 2, the two different foc's give rise to the following functions:

$$q_i^{\mathcal{X}}(q_j) = \frac{1}{2}(\alpha - w_i - \gamma q_j)$$
$$q_j^{\mathcal{X}}(w_j; \tilde{q}_i) = \frac{1}{2}(\alpha - w_j - \gamma \tilde{q}_i)$$

$\mathcal{R}_i$ observes $\mathcal{R}_j$'s contract terms and thus he can react optimally ($q_i^{\mathcal{X}}$ is a function of both (w_i, w_j)). On the other hand, $\mathcal{R}_j$ cannot observe $\mathcal{R}_i$'s contract terms, and has to form beliefs in the form of $\tilde{q}_i$.

In Stage 1, the two different generalized asymmetric Nash bargain products are:

$$\begin{aligned}\mathcal{N}_i^{\mathcal{X}}(w_i, w_j, F_i) = [(q_i^{\mathcal{X}}(w_i, w_j))^2 - F_i]^{1-\beta}[(w_i - c)q_i^{\mathcal{X}}(w_i, w_j)+ \\ + (w_j - c)q_j^{\mathcal{X}}(w_i, w_j) + F_i - (w_j - c)q_j^m(w_j)]^\beta \\ \mathcal{N}_j^{\mathcal{X}}(w_i, w_j, F_j; \tilde{q}_i) = [(q_j^{\mathcal{X}}(w_j; \tilde{q}_i))^2 - F_j]^{1-\beta}[(w_i - c)\tilde{q}_i+ \\ + (w_j - c)q_j^{\mathcal{X}}(w_j; \tilde{q}_i) + F_j - (w_i - c)q_i^m(w_i)]^\beta\end{aligned}$$

Maximizing each Nash bargain product over its respective wholesale price and fixed fee, and following the standard procedure, we get the equilibrium values stated below:

$$w_i^{\mathcal{X}} = c - \frac{(2-\gamma)\gamma^2\tilde{\alpha}}{4(2-\gamma^2)}, \quad q_i^{\mathcal{X}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}, \quad p_i^{\mathcal{X}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha}$$
$$w_j^{\mathcal{X}} = c, \quad q_j^{\mathcal{X}} = \frac{(4-\gamma(\gamma+2))\tilde{\alpha}}{4(2-\gamma^2)}, \quad p_j^{\mathcal{X}} = \alpha - \frac{(4+\gamma(2-3\gamma))\tilde{\alpha}}{4(2-\gamma^2)}$$

The following Lemma summarizes.

Lemma 9. *Under Cournot competition downstream, mixed regime, two-part tariffs, and linear demand:*

1. *Both wholesale prices are bargain power independent, while the firm who observes the rival has wholesale price below marginal cost:* $w_i^{\mathcal{X}} < w_j^{\mathcal{X}} = c$.
2. *Both quantities are bargain power independent, while the firm who observes the rival has higher output:* $q_i^{\mathcal{X}} > q_j^{\mathcal{X}}$. *As for product differentiation, the following holds:* $\frac{\partial q_i^{\mathcal{X}}}{\partial \gamma} < 0 \Leftrightarrow \gamma < 0.58$, *while* $\frac{\partial q_j^{\mathcal{X}}}{\partial \gamma} < 0$.
3. *Both retail prices are bargain power independent, and both decrease as product's become more homogeneous:* $\frac{\partial p_i^{\mathcal{X}}}{\partial \gamma} < 0$ *and* $\frac{\partial p_j^{\mathcal{X}}}{\partial \gamma} < 0$. *The firm who does not observe the rival sets higher retail price:* $p_j^{\mathcal{X}} > p_i^{\mathcal{X}}$.
4. *Fixed fees rise with bargain power, while the firm who observes the rival pays higher fixed fee:* $F_i^{\mathcal{X}} > F_j^{\mathcal{X}}$.

The intuition for this Lemma is along the lines of the two previous Lemmata. Higher bargain power will not change equilibrium quantities (and thus equilibrium retail prices) or equilibrium wholesale prices. But, it will affect downstream firms' profits, because a stronger upstream manufacturer will exploit the downstream firms through the use of the fixed fee. The common upstream manufacturer has maximum profits when products are independent (for $\gamma \to 0$), because $\frac{\partial \Pi^{\mathcal{X}}}{\partial \gamma} < 0$.

2.3.4 Disclosure regime set-up

In the pre-stage, each of the three firms of the game (the common upstream manufacturer, and the two rival downstream retailers) decide simultaneously and separately over the disclosure regime that maximizes firm's profits. For a contract to be interim unobservable, both bargain parties must decide to keep it secret (equivalently, both firms must sign a non–disclosure agreement). For a contract to be interim observable, at least one of the bargain parties must decide to disclose the contract terms (equivalently, one bargain party must decide not to sign the non–disclosure agreement).[18]

When the contract is signed, there is no reason to change the disclosure regime, because this will not change the contract terms. To illustrate this proposition, assume that the manufacturer bargains with both retailers under the interim unobservable regime. This will lead to the known result: $w_i = w_j = c$. Now, let assume that after both contracts are signed, the common manufacturer publicly announces the contract terms of both contracts. Thus, retailers will compete in the product market under interim observability. The equilibrium output for interim observability is: $q_i^{\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$. Because the contracts have been signed, retailers will pay a wholesale price equal to marginal cost, no matter the disclosure regime in place. Substituting, we get: $q_i^{\mathcal{O}}(c, c) = \frac{\alpha-c}{2+\gamma} = q_i^{\mathcal{S}}$. So, a change in the disclosure regime with no renegotiations will not change the retailers' output. Similar reasoning holds for the deviation from interim observable into interim unobservable contracts (even though

[18] The non–disclosure agreement is a legal contract, often part of the pre-contractual arrangements in a deal between two (or more) bargain parties. If violated, then the courts could decide to penalize the violator.

this deviation is not realistic). The following Lemma summarizes.

Lemma 10. *Any deviation in the disclosure regime after the sign of the contracts, cannot change the equilibrium results of the product market competition.*

From another point of view, the disclosure regime set–up is a pre–contractual arrangement or else *letter of comfort*.[19] As such, it can no longer be considered as "cheap talk" but are now endowed with commitment value and can be used strategically by the bargaining parties. These are valid especially when the pre–contractual arrangement contains well-defined legal elements in the text and it is written in a way that produces legal liability under the rule of reliance (Furmston et al., 2010). Having that in mind, we state the following Proposition. The proof of this proposition can be found in the Appendix.

Proposition 2.3.1. *Under Cournot competition, a common supplier, and bargain over two-part tariffs, both universal interim observability, and universal interim unobservability can arise as equilibria, with the former equilibrium Pareto dominating the latter.*

Proposition 2.3.1 suggests that independent of the supplier's bargain power or the degree of product substitutability (i.e. the competitive pressure) in the product market, both disclosure regimes could arise endogenously as equilibria. This is not something far from practical observations of the real business world; from economic sector to another, or even within the same, disclosure regimes vary. Note that asymmetric equilibria never arise, while the universal interim observability equilibrium Pareto dominates the universal interim unobservability equilibrium.

Under interim observability, the upstream supplier cannot use the wholesale price in order to influence the downstream competition, due to the lack of strategic interaction between

[19]In legal terminology, a pre–contractual arrangement (or letter of comfort) frame the ensuing negotiations, which in turn determine the final contractual terms. Disclosure regime, seen as a contractual arrangement could not be considered as binding by the court, yet in most countries (the US and continental Europe included) could be seen by the court that at least engages the parties to continue negotiations in good faith over the open contract terms, and eventually sign the contract (Schwartz and Scott, 2007).

the rival retailers. On the contrary, under interim observability, the downward sloping reaction function of retailers' equilibrium output forces the common supplier to cut wholesale prices below marginal cost, increase downstream gross profits and output, and then subsidy through the fixed fee. This situation is in favor of the consumers, as we will show in the next section 3.5.

Conventional wisdom suggests that suppliers should keep the contract terms secret, because this helps them to exploit both the retailers and the consumers. We show that interim observability provides a mean through which wholesale price goes below marginal cost and increases aggregate output and profits for all market participants. In contrast, interim unobservability deprives retailers from any strategic reaction and increases wholesale prices. Nevertheless, disclosure regime plays a crucial role in the determination of the downstream competition. As we will show latter on, the structure of the upstream market as well as the mode of the downstream competition could alter the forces at work.

2.4 Welfare Implications

2.4.1 Welfare Analysis

In this section, we will perform a welfare analysis and discuss briefly the regulator's incentives to encourage (or not) a certain disclosure regime over the other. Social welfare is defined as the sum of consumer surplus, retailers' profits, and manufacturer's profits:

$$SW = CS + (\pi_i + \pi_j) + \Pi$$

where $CS = \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$.[20] Substituting the relevant expressions, and after having some simple algebraic manipulations, we obtain the relevant SW expressions under the three different disclosure regimes. The following Proposition summarizes.

[20]Following Singh and Vives (1984), we substitute $p_i = \alpha - q_i - \gamma q_j$ into $u(q_i, q_j) - p_i q_i - p_j q_j$ and thus obtain the CS.

Proposition 2.4.1. *Social Welfare is higher under universal interim observability, and lower under universal interim unobservability:* $SW^{\mathcal{O}} > SW^{\mathcal{X}} > SW^{\mathcal{S}}$.

The proof of the Proposition can be found in the Appendix. Proposition 3.5.1 shows that the highest social welfare can be obtained only under universal interim observability of vertical contract terms. The results are driven by the output, which is higher (lower) under interim observability (unobservability) regime. The mixed regime creates a mixed situation, which stands between the two interim regimes. As a consequence, the interim observability is always preferable from the policy maker's point of view. This suggests that the policy makers should encourage interim observability in the vertical contracts.

2.4.2 Comparative Statics

The following Lemma highlights the comparative statics between the disclosure regimes. Comparing equilibrium values is quite straightforward, based on the relevant expressions stated above.

Lemma 11. *Under Cournot competition downstream, two-part tariffs and linear demand:*

1. *Output is higher in interim observability:* $q^{\mathcal{O}} = q_i^{\mathcal{M}} > q^{\mathcal{S}} > q_j^{\mathcal{X}}$.
2. *Wholesale price is lower in interim observability:* $w^{\mathcal{S}} = w_j^{\mathcal{X}} > w_i^{\mathcal{X}} > w^{\mathcal{O}}$.
3. *Retail price is higher in interim unobservability:* $p^{\mathcal{S}} > p_j^{\mathcal{X}} > p_i^{\mathcal{X}} > p^{\mathcal{O}}$.
4. *Fixed fee is higher in observability:* $F^{\mathcal{O}} = F_i^{\mathcal{X}} > F^{\mathcal{S}} > F_j^{\mathcal{X}}$.
5. *Retailers' profits are higher in interim observability:* $\pi^{\mathcal{O}} = \pi_i^{\mathcal{X}} > \pi^{\mathcal{S}} > \pi_j^{\mathcal{X}}$.
6. *Manufacturer's profits are higher in interim unobservability:* $\Pi^{\mathcal{S}} > \Pi^{\mathcal{X}} > \Pi^{\mathcal{O}}$.

A common upstream has incentives (higher profits) to bargain with both downstream retailers under interim unobservability, getting a higher (consumption dependent) wholesale price, and a lower (consumption independent) fixed fee. On the other hand, downstream retailers have incentives (higher profits) to bargain with the common manufacturer under interim observable contracts, paying a lower (consumption dependent) wholesale price, and a higher (consumption independent) fixed fee. Under the mixed regime, the upstream manufacturer collaborates with $\mathcal{R}_i$ to exploit $\mathcal{R}_j$'s profits.

2.5 Extensions

In this section, we will discuss some possible extensions of the basic model. The reasoning of these extensions is to show which forces at work will change if we move to a different downstream competition or a different contract type, or we introduce two separate suppliers. Section 3.6 deals with Bertrand competition in the product market, Section 2.5.2 deals with bargain over wholesale linear contracts, while Section 2.5.3 deals with two separate dedicated exclusive upstream suppliers. All the relevant conditions can be found in the Appendix. For the needs of this section, we use the following notation: superscript $\mathcal{BK}$ stands for Bertrand competition, $\mathcal{K}$ stands for linear contracts, and finally $\mathcal{K}$ stands for dedicated suppliers, while $K \in \{\mathcal{O}, \mathcal{S}, \mathcal{X}\}$.

2.5.1 Bertrand competition in the product market

In the aforementioned basic model, the firms produce a differentiated product and compete in quantities. This is because the wholesale market is better approximated by the quantity competition (Arya and Mittendorf, 2011). However, in this extension, we will consider how a shift to price competition could change the dynamics of the game. The following Lemma summarizes the equilibrium values in each regime.

Lemma 12. *Under Bertrand competition, a common supplier and bargain over two-part tariff contracts, the following equilibrium values hold per disclosure regime:*

(i) Under the universal interim observability regime,

$$w^{\mathcal{BO}} = c + \frac{1}{4}\gamma^2\tilde{\alpha}, \quad p^{\mathcal{BO}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha}, \quad q^{\mathcal{BO}} = \frac{(2+\gamma)\tilde{\alpha}}{4(1+\gamma)}$$

(ii) Under the universal interim unobservability regime,

$$w^{\mathcal{BS}} = c, \quad q^{\mathcal{BS}} = \frac{\tilde{\alpha}}{(2-\gamma)(1+\gamma)}, \quad p^{\mathcal{BS}} = \alpha - \frac{\tilde{\alpha}}{2-\gamma}$$

(iii) Under the mixed regime,

$$w_i^{\mathcal{BX}} = c + \frac{\gamma^2(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_i^{\mathcal{BX}} = \frac{(2+\gamma)\tilde{\alpha}}{4(1+\gamma)}, \quad p_i^{\mathcal{BX}} = \alpha - \frac{(4+\gamma(6+\gamma(2+\gamma)))\tilde{\alpha}}{8(1+\gamma)}$$
$$w_j^{\mathcal{BX}} = c + \frac{\gamma^3(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_j^{\mathcal{BX}} = \frac{(4+\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}, \quad p_j^{\mathcal{BX}} = \alpha - \frac{(4+3\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}$$

Notice that under interim observability, and in contract to Cournot competition, wholesale price is above marginal cost. This is due to the upward sloping reaction functions in Bertrand: when one retailer reduces his retail price, it is in the best interest of the rival retailer to reduce it as well. Given the fact that wholesale and retail prices are positive correlated $\frac{\partial p}{\partial w} > 0$, this could extinguish the manufacturer's profits, and thus the manufacturer has to restrict downstream competition by agreeing on a wholesale price above the marginal cost. This has an impact on both the quantities sold and the fixed fee extracted by the manufacturer.

Proposition 2.5.1. *Under Bertrand competition, a common supplier, and bargain over two-part tariffs, the unique equilibrium is the universal interim observability.*

Price competition can alter firm's strategic incentives and the forces at work, and bring out the universal interim observability as the sole equilibrium disclosure regime. A common supplier wishes to soften downstream competition, and with prices being strategic complements, can only do so by choosing to reveal vertical contract's terms. The main driver of the result of Proposition 2.5.1 is that price competition differs from quantity competition because contracts are more inherently independent (Arya and Mittendorf, 2011).

Using the social welfare formula stated in section 3.5, and after some simple algebraic manipulations, it is easy to show that: $\forall \beta, \gamma \in (0,1) : SW^{\mathcal{BS}} > SW^{\mathcal{BO}}$. Surprisingly, a policymaker who cares for the maximum social welfare, and when retailers compete over prices in the product market, should encourage for less disclosure, leading to interim unobservability of vertical contract terms.

Furthermore, notice that: $\forall \beta, \gamma \in (0,1): w^{\mathcal{BS}} < w^{\mathcal{BO}}, \quad p^{\mathcal{BS}} < p^{\mathcal{BO}}$, while $q^{\mathcal{BS}} > q^{\mathcal{BO}}$, and $F^{\mathcal{BS}} > F^{\mathcal{BO}}$. In contrast to the Cournot case, when firms compete over prices, wholesale and retail price are lower under interim unobservability, while output and fixed fee are lower under interim observability. This comes to defense the previous paragraph mentioning the social welfare: when firms bargain over secrecy, they manage to keep retail price low and they give the higher fixed fee to their supplier, leading to lower net profits for them.

2.5.2 Bargaining over wholesale linear contracts

The use of two–part tariff contracts: (i)eliminates double marginalization problem, (ii)it maximizes joint profits, and (iii)distributes the maximized "pie"according to each member's bargain power. All these three characteristics are absent in wholesale contracts (Milliou and Petrakis, 2007). Nevertheless, common knowledge dictates that wholesale contracts are in wide use all over the business world. On these grounds, therefore it is quite useful and interesting to characterize the disclosure regime equilibrium when bargain pairs use wholesale contracts. The following Lemma summarizes.

Lemma 13. *Under Cournot competition, a common supplier and bargain over linear contracts, the following equilibrium values hold per disclosure regime:*

(i) Under the universal interim observability regime:

$$w^{\mathcal{O}} = c + \frac{1}{2}\beta\tilde{\alpha}, \quad q^{\mathcal{O}} = \frac{(2-\beta)\tilde{\alpha}}{2(2+\gamma)}, \quad p^{\mathcal{O}} = \alpha - \frac{(2-\beta)(1+\gamma)\tilde{\alpha}}{2(2+\gamma)}$$

(ii) Under the universal interim unobservability regime,

$$w^{\mathcal{S}} = c + \frac{2\beta\tilde{\alpha}}{4+\gamma(\beta-(1-\beta)\gamma)}, \quad q^{\mathcal{S}} = \frac{(2-(1-\beta)\gamma-\beta)\tilde{\alpha}}{4+\gamma(\beta-(1-\beta)\gamma)}$$
$$p^{\mathcal{S}} = \alpha - \frac{(1+\gamma)(2-\beta(1-\gamma)-\gamma)\tilde{\alpha}}{4+\gamma(\beta-(1-\beta)\gamma)}$$

(iii) Under the mixed regime,

$$w_i^{\mathcal{X}} = c + \frac{(\beta+\gamma)\tilde{\alpha}}{2+\gamma},\ q_i^{\mathcal{X}} = \frac{(2-\beta)\tilde{\alpha}}{2(2+\gamma)},\ p_i^{\mathcal{X}} = \frac{(2-\beta)^2(\gamma((2+\beta)\gamma+4)-8)^2\tilde{\alpha}^2}{16(2-\gamma)^2(2+\gamma)^4}$$
$$w_j^{\mathcal{X}} = c + \frac{\beta(4+\beta\gamma)\tilde{\alpha}}{4(2+\gamma)},\ q_j^{\mathcal{X}} = \frac{(2-\beta)(4+\beta\gamma)\tilde{\alpha}}{8(2+\gamma)},\ p_j^{\mathcal{X}} = \alpha - \frac{(2-\beta)(4+(4+\beta)\gamma)\tilde{\alpha}}{8(2+\gamma)}$$

Proposition 2.5.2. *Under Cournot competition, a common supplier, and bargain over linear contracts, the unique equilibrium is the universal interim observability.*

Linear contracts lack some important features of the two–part tariff contracts, but nevertheless are in wide use all over the world. The lack of proper distribution of vertical chain's profits, based on each participant's bargain power, push both members of the bargain pair to seek universal interim observability. Notice that: $k^{\mathcal{S}} > k^{\mathcal{O}} \Leftrightarrow \beta > \frac{\gamma}{1+\gamma}$, where: $k \in \{\pi, w, p\}$, while $m^{\mathcal{S}} > m^{\mathcal{O}} \Leftrightarrow \beta < \frac{\gamma}{1+\gamma}$, where: $m \in \{\Pi, q\}$. The intuition behind this is straightforward: for an area of low (high) bargain power, firms wish to bargain under secrecy (observability), but it is in the best interest of the supplier to make the contract terms observable (secret).

Using the social welfare formula stated in section 3.5, and after some simple algebraic manipulations, it is easy to show that: $\forall \beta, \gamma \in (0,1) : SW^{\mathcal{S}} < SW^{\mathcal{O}}$. Obviously, a policymaker who cares for the maximum social welfare, and when wholesale contracts prevail, should encourage for more disclosure, leading to the interim observability of vertical contract terms. The following Lemma compares the equilibrium outcomes between the two types of contracts.

Lemma 14. *Under Cournot competition, and one common upstream monopolist,* $w^{\mathcal{O}} < c <$ $w^{\mathcal{O}} >$ *and* $c = w^{\mathcal{S}} < w^{\mathcal{S}}$.

The economic intuition behind this result is based on the so–called "output externality" (Horn and Wolinsky, 1988). Under wholesale contracts, a decrease on the wholesale price below marginal cost could not be subsidized by a fixed fee, thus it will lead to negative profits for the upstream supplier (either one common or two separate). Because the output externality in the case of linear contracts is positive (a negative output externality is possible only under non-linear contracts, see the following Lemma 16), a common upstream could internalize it (because he sells to both retailers), in contrast to a dedicated supplier (Milliou and Petrakis, 2007).

2.5.3 Dedicated upstream suppliers

The upstream market structure plays an important role in the contract type selection (Milliou and Petrakis, 2007). Consequently, we expect to play a role in the disclosure regime selection. In this extension, we will change the vertical chain by assigning an exclusive dedicated upstream supplier to each downstream retailer. As Arya and Mittendorf (2011) notice, a common upstream supplier has incentives to treat downstream competition as intra–brand, and thus seeks to soften it by inflating retail prices. In contrast, a dedicated upstream supplier treats downstream competition as inter–brand, and thus has to gain from fierce price cuts. The following Lemma summarizes.

Lemma 15. *Under Cournot competition, dedicated suppliers and bargain over two-part tariff contracts, the following equilibrium values hold per disclosure regime:*

(i) Under the universal interim observability regime,

$$w^{\mathcal{O}} = c - \frac{\gamma^2 \tilde{\alpha}}{4 + (2-\gamma)\gamma}, \quad q^{\mathcal{O}} = \frac{2\tilde{\alpha}}{4 + (2-\gamma)\gamma}, \quad p^{\mathcal{O}} = \alpha - \frac{2(1+\gamma)\tilde{\alpha}}{4 + (2-\gamma)\gamma}$$

(ii) Under the universal interim unobservability regime,

$$w^{\mathcal{S}} = c, \quad q^{\mathcal{S}} = \frac{\tilde{\alpha}}{\gamma + 2}, \quad p^{\mathcal{S}} = \alpha - \frac{(1+\gamma)\tilde{\alpha}}{2+\gamma}$$

(iii) Under the mixed regime,

$$w_i^{\mathcal{X}} = c - \frac{(2-\gamma)\gamma^2\tilde{\alpha}}{4(2-\gamma^2)}, \quad q_i^{\mathcal{X}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}, \quad p_i^{\mathcal{X}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha}$$
$$w_j^{\mathcal{X}} = c, \quad q_j^{\mathcal{X}} = \frac{(4-\gamma(2+\gamma))\tilde{\alpha}}{4(2-\gamma^2)}, \quad p_j^{\mathcal{X}} = \alpha - \frac{(4-\gamma(3\gamma-2))\tilde{\alpha}}{4(2-\gamma^2)}$$

Proposition 2.5.3. *Under Cournot competition, dedicated suppliers, and bargain over two-part tariffs, the unique equilibrium is the universal interim unobservability.*

Proposition 2.5.3 offers an interesting insight in the difference between a common or dedicated suppliers. Notice that $\forall \beta, \gamma \in (0,1) : w^{\mathcal{O}} < w^{\mathcal{S}} = c$, but $F^{\mathcal{O}} > F^{\mathcal{S}}$, and $\Pi^{\mathcal{O}} < \Pi^{\mathcal{S}}$. That is, a dedicated supplier has higher profits under interim unobservability, even though the higher wholesale price could lead to lower output and higher retail prices. The following Lemma compares the equilibrium outcomes of the two–part tariff contracts under one common or two separate upstream supplier(s).

Lemma 16. *Under Cournot competition and two–part tariffs, the following inequalities hold:* $w^{\mathcal{S}} = w^{\mathcal{S}} = c$ *and* $F^{\mathcal{S}} = F^{\mathcal{S}}$*, while* $w^{\mathcal{O}} < w^{\mathcal{O}} < c$ *and* $F^{\mathcal{O}} < F^{\mathcal{O}}$*.*

The economic intuition behind this Lemma is as follows. When the bargains are under interim unobservable (secret) contracts, the status of the upstream market could not change the incentives of the upstream supplier to bargain using a wholesale price equal to marginal cost, neither could help him to extract a higher fixed fee. On the contrary, when the bargains are under interim observable contracts, a dedicated supplier has incentives to trade with a higher wholesale price but lower fixed fee compared to the upstream monopolist. the intuition behind this result is based on the so–called "output externality"(Milliou and Petrakis, 2007). An increase in w_i will not only decrease q_i but it will also increase q_j (downward sloping reaction functions). Under two–part tariffs, this output externality is negative. An upstream monopolist dealing with both retailers could internalize this negative output externality and compensate from both retailers via the fixed fee, and thus has higher incentives to keep wholesale prices as low as possible, compared to a dedicated upstream supplier.

Using the social welfare formula stated in section 3.5, and after some simple algebraic manipulations, it is easy to show that: $\forall \beta, \gamma \in (0,1) : SW^{\mathcal{S}} < SW^{\mathcal{O}}$. Obviously, a policymaker who cares for the maximum social welfare, and when exclusivity in the supply chain prevails, should encourage for more disclosure, leading to the interim observability of vertical contract terms.

Merger incentives

In this section, we will examine the upstream firms' merger incentives under interim unobservable contracts. Milliou and Petrakis (2007) have shown that when firms bargain over interim observable two–part tariff contracts, then the upstream suppliers always prefer to remain separate. This is in contrast to the merger incentives under linear contracts, who favor the upstream merger (Horn and Wolinsky, 1988). The following Lemma states our result.

Lemma 17. *Under Cournot competition downstream, two–part tariff contracts and interim unobservability, the upstream suppliers are indifferent between merging horizontally or not.*

The proof of this Lemma comes from a straightforward algebraic manipulation of the difference of the upstream profits $\Pi^{S} - 2\Pi^{S}$, which is equal to zero $\forall \beta, \gamma \in (0, 1)$. The relevant equilibrium expressions of the upstream profits could be found in the Appendix. The economic intuition behind this Lemma is the following. A downstream firm who trades with his upstream supplier under secrecy deprives any strategic interaction with his rival retailer. So, the equilibrium output will be the same under both merger cases. Consequently, the upstream supplier will extract the fixed fee the same amount of joint surplus, no matter if he trades with both retailers or not. So, effectively, has no incentives to merge. This result is new to the relevant literature, and underlines the importance of the disclosure regime because the latter could severely affect the upstream firms' incentives to merge.

2.6 Conclusions

There is a vivid discussion, over the past year, about the enhancement of competition an augmented disclosure of contract terms could bring. Vertical contracts and the various contractual provisions give rise to serious competition concerns. Among the latter is the disclosure regime of the contract's terms. For the last decades, policymakers around the world have opted for more disclosure, but is this decision in the right direction?

To answer this question we have setup a differentiated two-tier market duopoly model, in which firms, both upstream and downstream, decide over the desired disclosure regime. For a contract to have interim observable terms, at least one bargain member should announce them; for a contract to have interim unobservable terms, both bargain members should keep them secret. We have shown that once the bargaining stage is over, there is no reason for any firm to deviate from its disclosure regime because this will not change the contract terms.

A Cournot duopolist facing a single supplier and bargaining over a two-part tariff contract has incentives to reveal the contract terms. The same holds for the supplier himself. Even if the retailers compete in quantities, or the vertical chain bargain over linear wholesale contracts, the forces at work won't change, leaving the disclosure regime equilibrium exactly the same. On the other hand, a dedicated supplier has incentives to bargain with his respective retailer over interim unobservable contracts. Even if this lowers the output and makes the product more expensive, it is a disclosure regime that maximizes the profits of both members of the vertical chain.

The following two tables summarize the findings of the paper.

	Cournot Common U TPT	Bertrand Common U TPT	Cournot Dedicated U_i TPT	Cournot Common U Linear
Observable	X	X		X
Unobservable	X		X	

Table 2.1: Optimal disclosure regime; upstream firms' point of view.

Table 2.1 summarizes the disclosure regime equilibria stated in this paper. When firms compete over quantities, the upstream market structure as well as the type of the contract play a significant role in the disclosure regime setup. A common upstream who bargains over a two–part tariff contract, treats downstream competition as intra-brand competition and he is willing to accept both interim observability and unobservability, even though the former Pareto dominates the latter. Under contrary, when the same common supplier bargains over linear contract, due to double marginalization and the lack of joint profit maximization, he is not willing to bargain under interim unobservability. At the same time, the existence of two separate dedicated exclusive upstream suppliers could change, once again, the disclosure regime equilibrium. The latter, understanding the downstream competition as inter-brand competition, are willing to bargain under interim unobservability to give their respective retailers a competitive advantage over the rival firm. On the other hand, when firms compete over prices, the strategic complementarity of the differentiated products pushes the common upstream to bargain under interim observability only. This decision softens downstream competition by charging higher wholesale prices, and thus avoiding any unnecessary (for them) intensity of the competition.

	Cournot Common U TPT	Bertrand Common U TPT	Cournot Dedicated U_i TPT	Cournot Common U Linear
Observable	X		X	X
Unobservable		X		

Table 2.2: Optimal disclosure regime; policymaker's point of view.

The picture seems to change when it comes for a policymaker to choose the disclosure regime that maximizes social welfare (Table 2.2). It seems that the existence of a common upstream supplier and downstream competition over quantity guarantees the alignment of interests between the firms and the policymaker. On the opposite side, when firms compete over prices, or the upstream market is not monopolized, the interests of the firms are the opposite of the policymaker.

This paper focused on a theoretical approach to the disclosure regime of vertical contracts. We have shown that the downstream competition mode and intensity, as well as the upstream market structure play a significant role in the observability or not of the vertical contracts. Any future work should be focused on the empirical side of this problem. There is a testable implication that emerges from thee findings. The theoretical model implies that exclusivity leads to poor disclosure. It might be quite interesting to check if data from the real world show a correlation between upstream market competition and disclosure regime of the vertical contracts.

Our findings lead to a number of testable implications. First, the usage of observable contracts in sectors with Bertrand type competition must be relatively high, compared to sectors with Cournot type of competition. Further, the usage of observable contracts from firms in sectors with a monopolist supplier must be significantly higher compared to sectors with dedicated suppliers.

There are a few questions still open in the theoretical literature. For instance, Manasakis and Petrakis (2009) analyze the impact of the usptream market structures on the firms' incentives to form research joint ventures (RJV's) aiming to split high R&D costs and share positive spillovers. An interesting direction for further research could be to study the role of observability or secrecy on the formation of research joint ventures, and whether disclosure regime could ease the hold–up problem provoked by the presence of a powerful upstream monopolist.

2.7 Appendix

2.7.1 Proofs

Proof. Proposition 2.3.1. The equilibrium profits of the firms π_i and the common supplier Π, under different disclosure regimes are:

$$\begin{aligned}
\pi^{\mathcal{O}} &= \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \pi^{\mathcal{S}} = \frac{(1-\beta-1)\tilde{\alpha}^2}{(2+\gamma)^2} \\
\Pi^{\mathcal{O}} &= \frac{(2-\gamma)(\beta(2-\gamma)(2-\gamma^2)-\gamma^3)\tilde{\alpha}^2}{4(2-\gamma^2)^2} \\
\pi_i^{\mathcal{X}} &= \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \pi_j^{\mathcal{X}} = \frac{(1-\beta)(16-\gamma(16+\gamma^3-4\gamma))\tilde{\alpha}^2}{32(2-\gamma^2)} \\
\Pi^{\mathcal{S}} &= \frac{2\beta\tilde{\alpha}^2}{(2+\gamma)^2}, \quad \Pi^{\mathcal{X}} = \frac{(\beta(2-\gamma^2)(32-\gamma(32+\gamma^3-8\gamma))-\gamma^3(8+\gamma^3-8\gamma))\tilde{\alpha}^2}{32(2-\gamma^2)^2}
\end{aligned}$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision.

(i) After some simple algebraic manipulations, it is easy to show that: $\forall\beta,\gamma \in (0,1)$: $\pi^{\mathcal{S}} > \pi_j^{\mathcal{X}}$ and $\Pi^{\mathcal{S}} > \Pi^{\mathcal{X}}$, thus universal interim unobservability is an equilibrium.

(ii) It can be readily verified that for all β,γ in $(0,1)$ the following hold: $\pi^{\mathcal{O}} = \pi_i^{\mathcal{X}}$ while $\Pi^{\mathcal{O}} < \Pi^{\mathcal{X}}$, so universal interim observability is an equilibrium.

(iii) If we Pareto rank them, universal interim observability dominates universal interim unobservability: $\forall\beta,\gamma \in (0,1): \quad \pi^{\mathcal{O}} > \pi^{\mathcal{S}}$. □

Proof. Proposition 3.5.1. The Social Welfare expressions are:

$$\begin{aligned}
SW^{\mathcal{O}} &= \frac{(8(1-\gamma)+\gamma^3)\tilde{\alpha}^2}{2(2-\gamma^2)^2}, \quad SW^{\mathcal{S}} = \frac{4\tilde{\alpha}^2}{(\gamma+2)^2} \\
SW^{\mathcal{X}} &= \frac{(128-\gamma(128+\gamma(16-(32-\gamma)\gamma)))\tilde{\alpha}^2}{32(2-\gamma^2)^2}
\end{aligned}$$

It can be readily verified that $\forall\beta,\gamma \in (0,1)$ the following inequalities hold: $SW^{\mathcal{O}} >$

$SW^{\mathcal{X}}$ and $SW^{\mathcal{X}} > SW^{\mathcal{S}}$. $\square$

Proof. Lemma 12. Assume the linear demand function: $q_i(p_i, p_j) = \frac{\alpha}{1+\gamma} - \frac{1}{1-\gamma^2}p_i + \frac{\gamma}{1-\gamma^2}p_j$, and price competition in the product market.

Universal Interim Observability regime: Under interim observability, the product market competition is characterized by the following equations: $\max_{p_i}[\pi_i(p_i, p_j)] \Rightarrow p_i^*(p_j) = \frac{1}{2}(\alpha(1-\gamma)+w_i+\gamma p_j)$. Following the standard procedure, we get: $p_i^{\mathcal{BO}}(w_i, w_j) = \frac{1}{4-\gamma^2}(\alpha(2-\gamma^2-\gamma)+2w_i+\gamma w_j)$. Moving to Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\mathcal{BO}}(w_i, w_j, F_i) = [\pi_i^{\mathcal{BO}}(w_i, w_j, F_i)]^{1-\beta}[\Pi^{\mathcal{BO}}(w_i, w_j, F_i, F_j) - (w_j - c)q_j^m(w_j) - F_j]^{\beta}$$

where: $\Pi^{\mathcal{BO}}(w_i, w_j, F_i, F_j) = (w_i-c)q_i^{\mathcal{BO}}(w_i, w_j)+(w_j-c)q_j^{\mathcal{BO}}(w_i, w_j)+F_i+F_j$ are $\mathcal{M}$'s profits, while $q_j^m(w_j)$ is the monopoly output realized by $\mathcal{R}_j$ in the case of a (non–permanent and non–irrevocable) breakdown in the negotiations between $\mathcal{R}_i$ and $\mathcal{M}$. Following the standard procedure, we get:

$$w^{\mathcal{BO}} = c + \frac{1}{4}\gamma^2\tilde{\alpha}, \quad q^{\mathcal{BO}} = \frac{(\gamma+2)\tilde{\alpha}}{4(\gamma+1)}, \quad p^{\mathcal{BO}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha}$$

In contrast to the interim observability regime under Cournot competition, wholesale price is above marginal cost, and it increases as products become more homogeneous $\frac{\partial w^{\mathcal{BO}}}{\partial\gamma} > 0$. Quantity and retail price are bargain power independent, while the fixed fee increases with bargain power $\frac{\partial F^{\mathcal{BO}}}{\partial\beta} > 0$. Quantity, retail price and fixed fee are always decreasing when products become more homogeneous $\frac{\partial p^{\mathcal{BO}}}{\partial\gamma} < 0$ and $\frac{\partial q^{\mathcal{BO}}}{\partial\gamma} < 0$ and $\frac{\partial F^{\mathcal{BO}}}{\partial\gamma} < 0$.

Universal Interim Unobservability regime: Having the same considerations as in Cournot case, and following the standard procedure, we get: $\max_{p_i}[\pi_i(p_i;\tilde{p}_j)] \Rightarrow p_i^{\mathcal{BS}}(w_i;\tilde{p}_j) = \frac{1}{2}(\alpha(1-\gamma)+\gamma\tilde{p}_j+w_i)$. We model the 1st Stage as follows:

$$\mathcal{N}_i^{\mathcal{BS}}(w_i, w_j, F_i;\tilde{p}_j) = [\pi_i^{\mathcal{BS}}(w_i, F_i;\tilde{p}_j)]^{1-\beta}[\Pi^{\mathcal{BS}}(w_i, w_j, F_i, F_j;\tilde{p}_j) - (w_j - c)q_j^m(w_j) - F_j]^{\beta}$$

where: $\Pi^{\mathcal{BS}}(w_i, w_j, F_i, F_j; \tilde{p}_j) = (w_i - c)q_i^{\mathcal{BS}}(w_i; \tilde{p}_j) + (w_j - c)q_j^{\mathcal{BS}}(w_i; \tilde{p}_j) + F_i + F_j$ are $\mathcal{M}$'s profits. Maximizing Nash product and following the standard procedure, we get:

$$w^{\mathcal{BS}} = c, \quad q^{\mathcal{BS}} = \frac{\tilde{\alpha}}{(2-\gamma)(\gamma+1)}, \quad p^{\mathcal{BS}} = \alpha - \frac{\tilde{\alpha}}{2-\gamma}$$

Wholesale price equals marginal cost, and thus is independent of the manufacturer's bargain power and the market features (such as product's differentiation). Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous: $\frac{\partial q^{\mathcal{BS}}}{\partial \gamma} < 0 \Leftrightarrow \gamma < 0.5$ and $\frac{\partial p^{\mathcal{BS}}}{\partial \gamma} < 0$. Fixed fee increases with bargain power $\frac{\partial F^{\mathcal{BS}}}{\partial \beta} > 0$, and decreases as products become more homogeneous $\frac{\partial F^{\mathcal{BS}}}{\partial \gamma} < 0$.

Mixed regime: Following the standard procedure we assume that bargain pair $(\mathcal{M}, \mathcal{R}_i)$ is under interim unobservability, while bargain pair $(\mathcal{M}, \mathcal{R}_j)$ is under interim observability. This gives rise to the following first order conditions: $\max_{p_i}[\pi_i(p_i; \tilde{p}_j)]$ and $\max_{p_j}[\pi_j(p_i, p_j)]$ lead to $p_i^{\mathcal{BX}}(w_i, w_j)$ and $p_j^{\mathcal{BX}}(w_j; \tilde{p}_i)$ respectively. Moving to the 1st stage, the two different asymmetric generalized Nash bargain products are:

$$\mathcal{N}_i^{\mathcal{BX}}(w_i, w_j, F_i) = [\pi_i^{\mathcal{BX}}(w_i, w_j, F_i)]^{1-\beta}[\Pi^{\mathcal{BX}}(w_i, w_j, F_i, F_j) - (w_j - c)q_j^m(w_j) - F_j]^\beta$$
$$\mathcal{N}_j^{\mathcal{BX}}(w_i, w_j, F_j; \tilde{p}_i) = [\pi_j^{\mathcal{BX}}(w_j, F_j; \tilde{p}_i)]^{1-\beta}[\Pi^{\mathcal{BX}}(w_i, w_j, F_i, F_j; \tilde{p}_i) - (w_i - c)q_i^m(w_i) - F_i]^\beta$$

Maximizing these two Nash products with respect to wholesale price and fixed fee, and having in mind that beliefs are true in equilibrium, we get:

$$w_i^{\mathcal{BX}} = c + \frac{\gamma^2(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_i^{\mathcal{BX}} = \frac{(2+\gamma)\tilde{\alpha}}{4(1+\gamma)}, \quad p_i^{\mathcal{BX}} = \alpha - \frac{(4+\gamma(6+\gamma(2+\gamma)))\tilde{\alpha}}{8(1+\gamma)}$$
$$w_j^{\mathcal{BX}} = c + \frac{\gamma^3(2+\gamma)\tilde{\alpha}}{8(1+\gamma)}, \quad q_j^{\mathcal{BX}} = \frac{(4+\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}, \quad p_j^{\mathcal{BX}} = \alpha - \frac{(4+3\gamma(2+\gamma))\tilde{\alpha}}{8(1+\gamma)}$$

Wholesale prices, quantities and retail prices are bargain power independent, while $w_i^{\mathcal{BX}}$ (respectively, $q_i^{\mathcal{BX}}$, $w_j^{\mathcal{BX}}$ and both retail prices) decrease (respectively, increase) as products become more homogeneous. □

Proof. Proposition 2.5.1. Based on the analysis and reasoning of the proof of the Lemma 12, the equilibrium values of profits, for both the supplier and the retailers, under all disclosure regimes, are stated below:

$$\pi^{\mathcal{BO}} = \frac{(1-\beta)(\gamma+2)(4+\gamma^4-\gamma^3-2\gamma)\tilde{\alpha}^2}{32(1+\gamma)}, \quad \pi^{\mathcal{BS}} = \frac{(1-\beta)(1-\gamma)\tilde{\alpha}^2}{(2-\gamma)^2(\gamma+1)}$$
$$\Pi^{\mathcal{BO}} = \frac{(2+\gamma)(4\beta-(1-\beta)\gamma^4+(1-\beta)\gamma^3-2\beta\gamma)\tilde{\alpha}^2}{16(1+\gamma)}, \quad \Pi^{\mathcal{BS}} = \frac{2\beta(1-\gamma)\tilde{\alpha}^2}{(2-\gamma)^2(\gamma+1)}$$
$$\pi_i^{\mathcal{BX}} = \frac{(1-\beta)(2+\gamma)(16+\gamma(8-\gamma(8-\gamma(4-\gamma(4-\gamma(2+\gamma(2+\gamma)))))))\tilde{\alpha}^2}{128(1+\gamma)^2}$$
$$\pi_j^{\mathcal{BX}} = \frac{(1-\beta)(32+(2-\gamma)\gamma(16+\gamma(2+\gamma)(2-\gamma(4+\gamma))))\tilde{\alpha}^2}{128(1+\gamma)^2}$$
$$\Pi^{\mathcal{BX}} = \frac{\beta\tilde{\alpha}^2}{128(1+\gamma)^2}[(64+\gamma(64-\gamma(16-\gamma(32-\gamma(18-\gamma(1+\gamma)(4+\gamma(3+\gamma)))))))+$$
$$+(1-\gamma)\gamma^3(1+\gamma)(2+\gamma)(4+\gamma(2+\gamma))]$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision. It can be readily verified that $\forall\beta,\gamma \in (0,1)$ the following inequalities hold:

(i) $\pi^{\mathcal{BS}} < \pi_j^{\mathcal{BX}}$ and $\Pi^{\mathcal{BS}} < \Pi^{\mathcal{BX}}$ thus universal interim unobservability can never be an equilibrium because both bargain parties have incentives to reveal the contract terms.

(ii) $\pi^{\mathcal{BO}} > \pi_i^{\mathcal{BX}}$ and $\Pi^{\mathcal{BO}} > \Pi^{\mathcal{BX}}$, so universal interim observability is an equilibrium because at least one of the bargain parties (in this case, both) has incentives to reveal the contract terms.

□

Proof. Lemma 13. We assume the same model, market structure, and disclosure regimes as in section 2.3, with the sole exemption of the usage of linear vertical contracts.

Universal Interim Observability Regime: The product market competition between the two retailers (Stage 2 of the game) is characterized by the following equations: $\max_{q_i}[\pi_i(q_i, q_j)] =$

$\max_{q_i}[(\alpha - q_i - \gamma q_j - w_i)q_i] \;\Rightarrow\; q_i^*(q_j) = \frac{1}{2}(\alpha - w_i - \gamma q_j)$. Following a similar reasoning for $\mathcal{R}_j$ and solving the system of the two reaction functions we get: $q_i^{\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$, $\pi_i^{\mathcal{O}}(w_i, w_j) = [q_i^*(w_i, w_j)]^2$. Moving to Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\mathcal{O}}(w_i, w_j) = [\pi_i^{\mathcal{O}}(w_i, w_j)]^{1-\beta}[\Pi^{\mathcal{O}}(w_i, w_j) - \frac{1}{2}(w_j - c)(\alpha - w_j)]^{\beta}$$

where: $\Pi^{\mathcal{O}}(w_i, w_j) = (w_i - c)q_i^{\mathcal{O}}(w_i, w_j) + (w_j - c)q_j^{\mathcal{O}}(w_i, w_j)$ are the profits of the manufacturer $\mathcal{M}$ from selling through linear contracts to both retailers. Maximizing Nash product over the wholesale price we get: $\max_{w_i} \mathcal{N}_i^{\mathcal{O}}(w_i, w_j) \Rightarrow w_i^{\mathcal{O}}(w_j) = \frac{1}{2}\gamma w_j + \frac{2-\gamma}{4}(2 + \tilde{\alpha}\beta)$. Following a similar reasoning for $\mathcal{R}_j$, solving the system of the foc's, and imposing symmetry in equilibrium, we get:

$$w^{\mathcal{O}} = c + \frac{1}{2}\beta\tilde{\alpha}, \quad q^{\mathcal{O}} = \frac{(2-\beta)\tilde{\alpha}}{2(\gamma+2)}$$

Wholesale price is above marginal cost $w^{\mathcal{O}} > c$, is independent of product's substitutability, and increases with bargain power: $\frac{\partial w^{\mathcal{O}}}{\partial \beta} > 0$. Quantity decreases as bargain power increases $\frac{\partial q^{\mathcal{O}}}{\partial \beta} < 0$. As products become more homogeneous ($\gamma \to 1$), quantity decreases $\frac{\partial q^{\mathcal{O}}}{\partial \gamma} < 0$.

Universal Interim Unobservability Regime: Maximizing profits over quantity we get: $\max_{q_i}[\pi_i(q_i; \tilde{q}_j)] \Rightarrow q_i^{\mathcal{S}}(w_i; \tilde{q}_j) = \frac{1}{2}(\alpha - w_i - \gamma\tilde{q}_j)$, $\pi_i^{\mathcal{S}}(w_i; \tilde{q}_j) = (q_i^{\mathcal{S}}(w_i; \tilde{q}_j))^2$. In Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\mathcal{S}}(w_i, w_j; \tilde{q}_j) = [\pi_i^{\mathcal{S}}(w_i; \tilde{q}_j)]^{1-\beta}[\Pi^{\mathcal{S}}(w_i, w_j; \tilde{q}_j) - \frac{1}{2}(w_j - c)(\alpha - w_j)]^{\beta}$$

where: $\Pi^{\mathcal{S}}(w_i, w_j; \tilde{q}_j) = (w_i - c)q_i^{\mathcal{S}}(w_i; \tilde{q}_j) + (w_j - c)\tilde{q}_j$ are the profits of $\mathcal{M}$. Maximizing Nash product over the wholesale price, and following the standard procedure, we get:

$$w^{\mathcal{S}} = c + \frac{2\beta\tilde{\alpha}}{4 + \gamma(\beta - (1-\beta)\gamma)}, \quad q^{\mathcal{S}} = \frac{(\beta(\gamma - 1) - \gamma + 2)\tilde{\alpha}}{4 + \gamma(\beta - (1-\beta)\gamma)}$$

Wholesale price is above marginal cost $w^{\mathcal{S}} > c$, it increases when $\mathcal{M}$'s bargain power increases $\frac{\partial w^{\mathcal{S}}}{\partial \beta} > 0$, and $\frac{\partial w^{\mathcal{S}}}{\partial \gamma} \gtrless 0 \Leftrightarrow \beta \lesseqgtr \beta_{crit} = \frac{2\gamma}{1+2\gamma}$. Quantity decreases when bargain power increases $\frac{\partial q^{\mathcal{S}}}{\partial \beta} < 0$, and it decreases as products become more homogeneous $\frac{\partial q^{\mathcal{S}}}{\partial \gamma} < 0$.

Mixed Regime: In the mix regime, we assume that $\mathcal{M}$ bargains with $\mathcal{R}_i$ under interim unobservability, and with $\mathcal{R}_j$ under interim observability. Consequently, in stage 2, the two retailers maximize different profit functions: $\max_{q_i}[\pi_i(q_i, q_j)] \Rightarrow q_i^{\mathcal{X}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$, while: $\max_{q_j}[\pi_j(q_j; \tilde{q}_i)] \Rightarrow q_j^{\mathcal{X}}(w_j; \tilde{q}_i) = \frac{1}{2}(\alpha - w_j - \gamma \tilde{q}_i)$. We model the bargains in Stage 1 using the generalized asymmetric Nash bargain product:

$$
\begin{aligned}
\mathcal{N}_i^{\mathcal{X}}(w_i, w_j) = {} & [(q_i^{\mathcal{X}}(w_i, w_j))^2]^{1-\beta}[(w_i - c)q_i^{\mathcal{X}}(w_i, w_j) + (w_j - c)q_j^{\mathcal{X}}(w_i, w_j) \\
& - \frac{1}{2}(w_j - c)(\alpha - w_j)]^{\beta} \\
\mathcal{N}_j^{\mathcal{X}}(w_i, w_j; \tilde{q}_i) = {} & [(q_j^{\mathcal{X}}(w_j; \tilde{q}_i))^2]^{1-\beta}[(w_i - c)\tilde{q}_i + (w_j - c)q_j^{\mathcal{X}}(w_j; \tilde{q}_i) - \frac{1}{2}(w_i - c)(\alpha - w_i)]^{\beta}
\end{aligned}
$$

Maximizing each Nash bargain product over its respective wholesale price, and following the standard procedure, we get:

$$
\begin{aligned}
w_i^{\mathcal{X}} &= c + \frac{(\beta + \gamma)\tilde{\alpha}}{2 + \gamma}, \quad q_i^{\mathcal{X}} = \frac{(2 - \beta)(\alpha - c)}{2(2 + \gamma)} \\
w_j^{\mathcal{X}} &= c + \frac{\beta(4 + \beta\gamma)\tilde{\alpha}}{4(2 + \gamma)}, \quad q_j^{\mathcal{X}} = \frac{(2 - \beta)(4 + \beta\gamma)\tilde{\alpha}}{8(2 + \gamma)}
\end{aligned}
$$

Both wholesale prices are above marginal cost $w_{i,j}^{\mathcal{X}} > c$, they both increase with bargain power $\frac{\partial w_{i,j}^{\mathcal{X}}}{\partial \beta} > 0$, while the unobserved wholesale price increases as products become more homogeneous $\frac{\partial w_i^{\mathcal{X}}}{\partial \gamma} > 0$, while the observable wholesale price decreases $\frac{\partial w_j^{\mathcal{X}}}{\partial \gamma} < 0$. Both quantities decrease as bargain power increases $\frac{\partial q_{i,j}^{\mathcal{X}}}{\partial \beta} < 0$. □

Proof. Proposition 2.5.2. Based on the analysis and reasoning of the Lemma 13, the equilibrium values for the supplier's and the retailers' profits are:

$$\pi^{\mathcal{O}} = \frac{(2-\beta)^2\tilde{\alpha}^2}{4(\gamma+2)^2}, \quad \Pi^{\mathcal{O}} = \frac{(2-\beta)\beta\tilde{\alpha}^2}{2(2+\gamma)}$$
$$\pi^{\mathcal{S}} = \frac{(2-\beta(1-\gamma)-\gamma)^2\tilde{\alpha}^2}{(4+\gamma(\beta-(1-\beta)\gamma))^2}, \quad \Pi^{\mathcal{S}} = \frac{4\beta(2-\beta(1-\gamma)-\gamma)\tilde{\alpha}^2}{(4+\gamma(\beta-(1-\beta)\gamma))^2}$$
$$\pi_i^{\mathcal{X}} = \frac{(2-\beta)^2\tilde{\alpha}^2}{4(2+\gamma)^2}, \quad \pi_j^{\mathcal{X}} = \frac{(2-\beta)^2(4+\beta\gamma)^2\tilde{\alpha}^2}{64(2+\gamma)^2}$$
$$\Pi^{\mathcal{X}} = \frac{(2-\beta)(\beta+16\gamma(32+\beta\gamma(8+\beta\gamma)))\tilde{\alpha}^2}{32(2+\gamma)^2}$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision. It can be readily verified that $\forall \beta, \gamma \in (0,1)$ the following inequalities hold:

(i) $\pi^{\mathcal{S}} < \pi_j^{\mathcal{X}}$ and $\Pi^{\mathcal{S}} < \Pi^{\mathcal{X}}$ thus universal interim unobservability can never be an equilibrium because both bargain parties have incentives to reveal the contract terms.

(ii) $\pi^{\mathcal{O}} > \pi_i^{\mathcal{X}}$ and $\Pi^{\mathcal{O}} > \Pi^{\mathcal{X}}$, so universal interim observability is an equilibrium because at least one of the bargain parties (in this case, both) has incentives to reveal the contract terms. □

Proof. Lemma 15. We assume the same model and market structure, and the same disclosure regimes as in section 2.3, with the sole exemption of the existence of two dedicated separate exclusive upstream suppliers.

Universal Interim Observability Regime: The product market competition between the two retailers (Stage 2 of the game) is characterized by the following equations:

$$\max_{q_i}[\pi_i(q_i, q_j, F_i)] = \max_{q_i}[(\alpha - q_i - \gamma q_j - w_i)q_i - F_i] \Rightarrow q_i^*(q_j) = \frac{1}{2}(\alpha - w_i - \gamma q_j)$$

Following a similar reasoning for $\mathcal{R}_j$ and solving the system of the two reaction functions we get: $q_i^{\mathcal{O}}(w_i, w_j) = \frac{\alpha(2-\gamma)-2w_i+\gamma w_j}{4-\gamma^2}$, $\pi_i^{\mathcal{O}}(w_i, w_j, F_i) = [q_i^*(w_i, w_j)]^2 - F_i$. Moving to Stage

1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\mathcal{O}}(w_i, w_j, F_i) = [\pi_i^{\mathcal{O}}(w_i, w_j, F_i)]^{1-\beta}[(w_i - c)q_i^{\mathcal{O}}(w_i, w_j) + F_i]^{\beta}$$

Following the standard procedure, we get:

$$w^{\mathcal{O}} = c - \frac{\gamma^2\tilde{\alpha}}{4 + (2-\gamma)\gamma}, \quad q^{\mathcal{O}} = \frac{2\tilde{\alpha}}{4 + (2-\gamma)\gamma}$$

Wholesale price is below marginal cost $w^{\mathcal{O}} < c$, is independent of bargain power, and decreases as products become more homogeneous: $\frac{\partial w^{\mathcal{O}}}{\partial \gamma} < 0$. Quantity is bargain power independent, and decreases as products become more homogeneous: $\frac{\partial q^{\mathcal{O}}}{\partial \gamma} < 0$.

Universal Interim Unobservability Regime: Maximizing profits over quantity we get:

$$\max_{q_i}[\pi_i(q_i; \tilde{q}_j)] \Rightarrow q_i^{\mathcal{S}}(w_i; \tilde{q}_j) = \frac{1}{2}(\alpha - w_i - \gamma\tilde{q}_j), \ \pi_i^{\mathcal{S}}(w_i, F_i; \tilde{q}_j) = (q_i^{\mathcal{S}}(w_i; \tilde{q}_j))^2 - F_i$$

In Stage 1, we model the generalized asymmetric Nash bargain product as follows:

$$\mathcal{N}_i^{\mathcal{S}}(w_i, w_j, F_i; \tilde{q}_j) = [\pi_i^{\mathcal{S}}(w_i, F_i; \tilde{q}_j)]^{1-\beta}[(w_i - c)q_i^{\mathcal{S}}(w_i; \tilde{q}_j) + F_i]^{\beta}$$

Maximizing Nash product over the wholesale price, and following the standard procedure, we get:

$$w^{\mathcal{S}} = c, \quad q^{\mathcal{S}} = \frac{\tilde{\alpha}}{2 + \gamma}$$

Wholesale price equals marginal cost, and is independent of the product's differentiation factor and the bargain power. Quantity is bargain power independent, and it decreases as products become more homogeneous $\frac{\partial q^{\mathcal{S}}}{\partial \gamma} < 0$.

Mixed Regime: In the mix regime, we assume that $\mathcal{M}$ bargains with $\mathcal{R}_i$ under interim unobservability, and with $\mathcal{R}_j$ under interim observability. Consequently, in stage 2, the two retailers maximize different profit functions:

$$\max_{q_i}[\pi_i(q_i, q_j, F_i)] \Rightarrow q_i^{\mathcal{X}}(w_i, w_j) = \frac{\alpha(2-\gamma) - 2w_i + \gamma w_j}{4-\gamma^2}$$
$$\max_{q_j}[\pi_j(q_j, F_j; \tilde{q}_i)] \Rightarrow q_j^{\mathcal{X}}(w_j; \tilde{q}_i) = \frac{1}{2}(\alpha - w_j - \gamma\tilde{q}_i)$$

We model the bargains in Stage 1 using the generalized asymmetric Nash bargain product:

$$\mathcal{N}_i^{\mathcal{X}}(w_i, w_j, F_i) = [(q_i^{\mathcal{X}}(w_i, w_j))^2 - F_i]^{1-\beta}[(w_i - c)q_i^{\mathcal{X}}(w_i, w_j) + F_i]^{\beta}$$
$$\mathcal{N}_j^{\mathcal{X}}(w_i, w_j, F_i; \tilde{q}_i) = [(q_j^{\mathcal{X}}(w_j; \tilde{q}_i))^2 - F_j]^{1-\beta}[(w_j - c)q_j^{\mathcal{X}}(w_j; \tilde{q}_i) + F_j]^{\beta}$$

Maximizing each Nash bargain product over its respective wholesale price, and following the standard procedure, we get:

$$w_i^{\mathcal{X}} = c - \frac{(2-\gamma)\gamma^2\tilde{\alpha}}{4(2-\gamma^2)}, \quad q_i^{\mathcal{X}} = \frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}$$
$$w_j^{\mathcal{X}} = c, \quad q_j^{\mathcal{X}} = \frac{(4-\gamma(2+\gamma))\tilde{\alpha}}{4(2-\gamma^2)}$$

Notice that $w_i^{\mathcal{X}} < c$ while $w_j^{\mathcal{X}} = c$, and they both are bargain power independent, while the unobserved wholesale price decreases as products become more homogeneous $\frac{\partial w_i^{\mathcal{X}}}{\partial\gamma} < 0$. Both quantities are bargain power independent, and the observed quantity decreases as products become more homogeneous $\frac{\partial q_i^{\mathcal{X}}}{\partial\gamma} < 0$. □

Proof. Proposition 2.5.3. Based on the analysis and reasoning of the Lemma 15, the equilibrium values for the supplier's and the retailers' profits are:

$$\pi^{\mathcal{O}} = \frac{2(1-\beta)(2-\gamma^2)\tilde{\alpha}^2}{(4+(2-\gamma)\gamma)^2}, \quad \Pi^{\mathcal{O}} = \frac{2\beta(2-\gamma^2)\tilde{\alpha}^2}{(4+(2-\gamma)\gamma)^2}$$
$$\pi^{\mathcal{S}} = \frac{(1-\beta)\tilde{\alpha}^2}{(2+\gamma)^2}, \quad \Pi^{\mathcal{S}} = \frac{\beta\tilde{\alpha}^2}{(2+\gamma)^2}$$
$$\pi_i^{\mathcal{X}} = \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \pi_j^{\mathcal{X}} = \frac{(1-\beta)(4-\gamma(2+\gamma))^2\tilde{\alpha}^2}{16(2-\gamma^2)^2}$$
$$\Pi_i^{\mathcal{X}} = \frac{\beta(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \Pi_j^{\mathcal{X}} = \frac{\beta(4-\gamma(2+\gamma))^2\tilde{\alpha}^2}{16(2-\gamma^2)^2}$$

For a contract to have interim observable terms, at least one member of the bargain must have incentives to publicly reveal these terms, after the end of the bargains but before the output decision. For a contract to have interim unobservable terms, all members of the bargain must keep the contract terms secret until the end of the output decision. It can be readily verified that $\forall \beta, \gamma \in (0, 1)$ the following inequalities hold:

(i) $\pi^{\mathcal{S}} > \pi_j^{\mathcal{X}}$ and $\Pi^{\mathcal{S}} > \Pi_j^{\mathcal{X}}$ thus universal interim unobservability is an equilibrium because both bargain parties have incentives not to reveal the contract terms.

(ii) $\pi^{\mathcal{O}} < \pi_i^{\mathcal{X}}$ and $\Pi^{\mathcal{O}} < \Pi_i^{\mathcal{X}}$, so universal interim observability can't be an equilibrium because both bargain parties have incentives to move to the mix regime. $\square$

3

Vertical arrangements and upstream mergers

3.1 Introduction

Recent upstream horizontal mergers puzzled the competition regulators in both sides of the Atlantic. The US–based courier firm UPS attempted to buy the Netherlands–based TNT in 2013 for a $7 billion deal, but the European regulators thwarted it. A couple of years later, the same regulators concurred for TNT to merge with the US–based FedEx, UPS's major rival, for a $5 billion deal. On the other hand, United Technologies refused a $90 billion merger attempt from the major conglomerate (and rival on the airspace systems) Honeywell on expectations that the deal would be blocked by the US regulators.[1] These are just some recent examples of horizontal upstream mergers who attracted a lot of attention from the antitrust regulators. All of these firms do not trade only with final consumers, but also with firms that operate in the intermediate stages of the production chain.[2]

An important aspect of the decision to merge or not is the contract type used in the bargaining process between the vertically related firms. Even though contract types could take many different forms, vertical structures try to overcome the known *market failure* problem by using non–linear contracts.[3] In the real business world, there exists a variety of different contract types. Some could be as simple as a linear consumption–based wholesale price, while other could be quite complicated.[4] Nevertheless, there is strong evidence that the contract terms are negotiated between upstream suppliers and downstream retailers (Thanassoulis and Smith, 2009).

The main consideration of this paper is to address the role of bargaining and contract type decision in the incentives and the welfare results of the upstream horizontal mergers. In this aspect, this research is closely related to the paper of Milliou and Petrakis (2007), in which the authors consider the same research question but for a contract type decision between linear or two–part tariff contracts. We deprive of their model by allowing firms to decide between two–part tariff contracts (hereafter *TPT*) or partial forward vertical ownership schemes (hereafter *PFVO*).[5]

[1]In the same spirit, US regulators blocked the 2011 merger between AT&T and T–Mobile, a $39 billion deal, because as they stated it will substantially lessen competition. On the contrary, the same regulators blocked the 2001 merger between US Airways and United Airlines but allowed the 2013 merger between the former and the American Airlines. Some successful upstream horizontal mergers are the $86 billion deal between the chemical giants DuPont and Dow Chemicals, or the $150 billion merger between the pharmaceuticals Pfizer and Allergan.

[2]Consider the "last–mile" transportation, in which major courier firms often outsource to local courier firms the delivery of the parcel from their hub to the final consumers. Also, Honeywell and United Technologies who supply engines to both the Boeing and the Airbus. Finally, the merged Dow Chemicals and DuPont supply chemicals to industries.

[3]Transaction costs, monitoring costs, the commitment problem, the hold–up problem, information asymmetry and many more could lead to market failure, leading to social welfare losses.

[4]Contract types are of great importance because they determine the allocation of risk, effort, and profits between the counterparties.

[5]There are many cases in which global manufacturers supply crucial spare parts, machinery, tech-

To fulfill our objective, we consider a vertical environment with two upstream manufacturers and two downstream retailers that are locked in exclusive relations.[6] The timing of the game is briefly as follows. In stage one, the manufacturers decide whether to merge horizontally or not. In stage two, the manufacturers decide the contract type to offer to the retailers.[7] If the manufacturers decide to merge, then in stage three the upstream monopolist bargains simultaneously and separately with both retailers. If, instead, the manufacturers remain separate, in stage three each manufacturer bargains with his exclusive dedicated retailer. The two contract types under consideration are the following. On the one hand, the two–part tariff contracts (TPT), consisting of a consumption dependent wholesale price w_i plus a consumption independent fixed fee F_i. On the other hand, the partial forward vertical ownership schemes (PFVO), consisting of a consumption dependent wholesale price w_i plus an ownership percentage $0 < s_i < 1$ over the downstream firm. In stage four, the retailers compete over quantities.

On these grounds, an upstream horizontal merger has two effects. First, it changes the manufacturers' bargain position by adding a disagreement payoff, and second, it allows for the internalization of the output externality.[8] Furthermore, as we will show later on, these two contract types, even if they have similar non–linear characteristics, they have very different effects on both the bargaining outcomes and the upstream merger decision. Even if both contracts use the w_i to maximize joint profits, the distribution of the maximized "pie" is quite different when we use F_i compared to the s_i.

Our contribution is three-fold. First, we highlight the significance of contract types for

nology or patents to local retailers under some partial forward vertical ownership schemes, which could lead to a joint venture structure. Whirlpool and Vestel for the local Turkish washing machines market and Hewlett-Packard and Tsinghua Holdings for the local Chinese printers market are two of them.

[6]Exclusive relations are observed in many industries. A sound example could be Apple, which had an exclusive distribution deal with AT&T for the first generation of the iPhones. Other minor examples could be petrol stations that deal exclusively with one petroleum supplier, KFC's and Domino's pizza who sells only Pepsi or MacDonald's who sells only Coca–Cola.

[7]We treat the contract type as a strategic decision of the upstream firms. In section 3.4.2 we treat the contract type decision as a strategic decision of the downstream firms, while in section 3.5 we allow the policymaker to decide which contract type maximizes the social welfare.

[8]The output externality refers to the situation in which an increase in the wholesale price charged in one retailer leads to higher output for the other retailer (Milliou and Petrakis, 2007).

the merger incentives. As in Milliou and Petrakis (2007), under TPT the manufacturers will not merge horizontally, but as Horn and Wolinsky (1988), under PFVO, the manufacturers will always decide to merge horizontally. Both outcomes are bargain power independent. This finding is due to the nature of the two different types of contracts. Under TPT, we consider the direct effect (output externality) of the substitution between w_i and F_i. In contrast, under PFVO, we consider not only the direct effect (output externality) of the substitution between w_i and s_i, but also to the indirect effect of w_i on the firm's profits. When the manufacturers decide to bargain separately, the direct effect of TPT is equal to the sum of the direct and the indirect effect of PFVO (leading to equal wholesale prices). When the manufacturers decide to merge, the sum of the direct and indirect effect of PFVO is higher than the direct effect of TPT (leading to lower wholesale prices under TPT compared to PFVO). For separate manufacturers, the indirect effect of PFVO compensates the dedicated manufacturer up to the level of the losses induced by the due to the higher wholesale price (compensates on par). On the other hand, when the manufacturers merge, the PFVO indirect effect overcompensates the common manufacturer for the higher wholesale price of PFVO compared to TPT (compensates above par). On the same grounds, when retailers compete over prices in the product market, it is always optimal for the upstream manufacturers to merge. This way, they can better internalize the so–called input externality, which we will explain later on.

Second, we show that the upstream market structure is crucial to the contract type selection. When the manufacturers refuse to merge, they are indifferent between TPT or PFVO or any other mix of these two contracts. This is due to the fact that no matter if they use F_i or s_i, they exploit the same amount of the maximized joint profits. In other words, under separate upstream firms, two–part tariffs are equivalent to partial forward vertical ownership schemes. On the other hand, when the manufacturers decide to merge, the common manufacturer prefers to offer PFVO to both retailers, because in this way he could exploit a bigger share of the maximized joint profits. The intuition behind this result is in line with the previous paragraph: under merged manufacturers, the sum of the direct and the indirect effect of PFVO is higher than the direct effect of TPT, leading to higher upstream profits. PFVO is a more efficient commitment device, compared to TPT, allowing the upstream monopolist to further exert his bargain power and to squeeze downstream's profits. Consequently, under one common upstream, two–part tariffs are not equivalent to partial forward vertical ownership agreements, with the latter being preferable from the upstream monopolist.

Third, we demonstrate that, under quantity competition in the product market, the contract type decision does not depend on the manufacturer's bargain power or to product market characteristics such as product differentiation. Our findings show that it is based solely on the upstream market structure. If the upstream manufacturers refuse to merge, then no matter who decides the contract type (manufacturer, retailer or policymaker), he will be indifferent from choosing between TPT or PFVO or even between offering any mix of them. On the other hand, if the manufacturers decide to merge, then if it is the common manufacturer who decides, he will choose PFVO. If the retailer is let to decide, he will choose TPT. The latter type of contract should be the policymakers choice as well because it maximizes social welfare. This finding suggests that the widely adopted assumption in the literature that the contract types could be exogenously determined, can mislead the market equilibrium and should not be considered as harmless. On the contrary, when retailers compete over prices, the common upstream manufacturer finds it more profitable to offer a TPT for intermediate bargain power, while to offer a PFVO for low bargain power. This is relevant to the indirect effect of wholesale prices on retailer's profits, as we will show in a subsequent section.

A paper closely related to ours is that of Milliou and Petrakis (2007). Their paper, in line to ours, considers both upstream market structures, the bargain between upstream and downstream firms as well as product market differentiation. We deprive of their model set up by allowing firms to decide between TPT and PFVO. Thus, one contribution of our paper is to show that under one common upstream manufacturer, these two types of contracts are not equivalent and rely on a different set of forces at work. They show that when the vertical chain uses linear contracts, and for sufficiently close substitutes $\gamma > 0.703$, the upstream manufacturers have always incentives to merge horizontally. For lower degrees of product substitutability, the manufacturers have incentives to merge horizontally if and only if $\beta <$

$\beta_M(\gamma)$. In contrast to their findings, we show that the social welfare is maximized when the manufacturers merge and use PFVO. In terms of policy implications, this finding suggests that the regulatory agencies should consider the contract types used before they decide to block an upstream merger.

This paper is connected to the vertical contracting literature. The core research question of this literature is the commitment problem that arises when an upstream monopolist deals with many rival retailers (O'Brien and Shaffer, 1992; Rey and Verge, 2004). Some papers consider the optimal choice of contract, between various contract types, but none has considered the optimal choice of contracts between PFVO and TPT.[9] Finally, our paper is also close to Alipranti et al. (2014) which, in a similar bargain framework, compares price and quantity competition outcomes. Our paper also contributes to the horizontal mergers in vertically related markets literature. Except for the aforementioned paper, a seminal work on this strand of the literature is the paper of Horn and Wolinsky (1988), who show that merger incentives are always present when the downstream firms compete in the product market.

The rest of the paper is structured as follows. In Section 3.2 we describe the model structure, the sequence of the events and the bargaining framework. In Section 3.3 we characterize the equilibrium outcomes and the merger incentives. In Section 3.5 we conduct welfare analysis and some comparative statics. In Section 3.6 we extend our analysis by assuming Bertrand competition in the product market. Finally, Section 3.7 offers the concluding remarks. The paper ends with the Appendix, in which all proofs are relegated, and of course the related References.

3.2 The Model

3.2.1 Market structure and disclosure regimes

We consider a two-tier industry, composed of two upstream manufacturers $\mathcal{M}_i$ and two downstream retailers $\mathcal{R}_i$ with $i = 1, 2$. We assume an "1–1" exclusive dedicated relation be-

[9] Sorensen (1992) considers the optimal choice between linear contracts and PFVO, while Milliou and Petrakis (2007) considers the optimal choice between linear contracts and TPT.

tween $\mathcal{M}_i$ and $\mathcal{R}_i$.[10] Each retailer $\mathcal{R}_i$ faces the following linear (inverse) demand function: $p_i(q_i, q_j) = \alpha - q_i - \gamma q_j$, where p_i and q_i are $\mathcal{R}_i$'s retail price and output respectively, while $0 < \gamma < 1$ shows that products are imperfect substitutes.[11] Each manufacturer $\mathcal{M}_i$ produces a differentiated good, under a constant unit cost $0 \leq c < \alpha$, while each retailer $\mathcal{R}_i$ faces no other cost except the cost of obtaining the input from its respective manufacturer $\mathcal{M}_i$. The latter is: either (a)a per–unit wholesale price w_i plus a profit–share percentage $0 < s_i < 1$ when trading is conducted over a *partial forward vertical ownership scheme* (PFVO), or (b)a per–unit wholesale price w_i plus a fixed fee F_i when trading is conducted via a *two–part tariff contract* (TPT).

3.2.2 Sequence of events and bargaining framework

We consider a four–stage game with observable actions. The sequence of events is summarized in Figure 3.1. Game timing reflects the idea that the long-run decisions (such as the upstream horizontal merger) have considerable effects on the short-run decisions (such as the output decision). In details, the timing of the game is as follows.

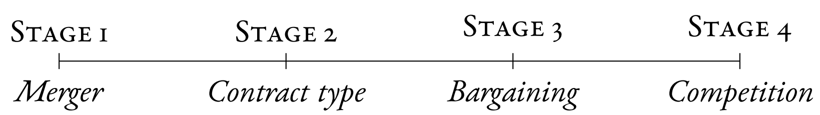


Figure 3.1: Game timing.

Stage 1: The merger decision stage. The two upstream manufacturers $\mathcal{M}_i,\ i = 1, 2$ decide whether to merge horizontally or not. If they decide to merge, they form a single upstream monopolist $\mathcal{M}$, supplying both retailers.

Stage 2: Contract type decision stage. Based on the decision made in Stage 1, either the two separate dedicated exclusive manufacturers $\mathcal{M}_i,\ i = 1, 2$ or the single upstream monopolist $\mathcal{M}$ decide over the preferred contract type, having to choose between (a)a partial forward

[10] This exclusive relation could emerge from various instances: irreversible R&D investments, tailor–made specific input manufacturing, exclusive local distribution etc.

[11] As in Singh and Vives (1984), we assume a unit mass of identical consumers, each having the same quadratic utility function $u(q_i, q_j) = \alpha(q_i + q_j) - \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$. Notice that a lower $\gamma \in (0, 1)$ indicates more differentiated products.

vertical ownership scheme (w_i, s_i) (PFVO), or (b)a two-part tariff contract (w_i, F_i) (TPT).[12] We label the case of both retailers receiving the former type of contract as the *Universal PFVO Case*, while we label the case of both retailers receiving the latter type of contract as the *Universal TPT Case*. There is also the possibility the manufacturer(s) to decide to trade with retailers using a combination of these two contracts e.g. using PFVO to trade with $\mathcal{R}_i$ and TPT to trade with $\mathcal{R}_j$. This case is labeled as the *Mixed Case*.

Stage 3: Bargaining stage. If there is no merge in Stage 1, then each manufacturer $\mathcal{M}_i, \quad i = 1, 2$ bargains with its respective retailer $\mathcal{R}_i, \quad i = 1, 2$ over the contract decided by the former in Stage 2. In case of a merger in Stage 1, $\mathcal{M}$ bargains simultaneously and separately with both $\mathcal{R}_i \quad i = 1, 2$, over the decided contract.[13] To model the bargaining stage, we use the generalized asymmetric Nash bargaining product (Milliou and Petrakis, 2007). Manufacturer(s) has bargain power $0 < \beta < 1$ while each retailer has bargain power $1 - \beta$. Due to the multiplicity of beliefs retailers form when they receive an out–of–equilibrium offer, multiple equilibria could arise. To remedy this situation, we obtain a unique equilibrium by imposing *pairwise proofness* on the equilibrium contracts. Pairwise proofness goes hand–in–hand with *passive beliefs*.[14] In the merger case, we also assume that the contract terms of one pair are *non-contingent* of any disagreements of the rival pair. This assumption captures nicely the idea that bargaining parties cannot commit to a permanent and irrevocable breakdown in their negotiations.[15]

[12]In section 3.4.2 we deprive of our model and we examine the case in which it is the retailers who decide the contract type in Stage 2.

[13]The simultaneous and separate bargains are standard in situations with multilateral contracting (Horn and Wolinsky, 1988; Milliou and Petrakis, 2007; Rey and Verge, 2004). It highlights the incentive each bargaining pair has to behave opportunistically. The rationale behind this assumption could be that the manufacturer has two representatives, each negotiating at the same time with a different retailer.

[14]Passive beliefs and pairwise proofness go hand in hand and are appropriate when we perceive the generalized asymmetric Nash bargaining solution as the limit equilibrium of alternating offers–counter–offers of a bargaining game (Binmore et al., 1986). In that case, passive beliefs state that $\mathcal{R}_i$ will handle any out–of–equilibrium offer from $\mathcal{M}$ as a "tremble", uncorrelated with any offer from $\mathcal{M}$ to $\mathcal{R}_j$. $\mathcal{R}_i$ believes that under any offer received from $\mathcal{M}$, the pair $(\mathcal{M}, \mathcal{R}_j)$ has reached an equilibrium outcome. This solution concept is used widely in the relevant literature. Note that different beliefs (e.g. wary beliefs) lead to other equilibrium outcomes, but in some cases are intractable (Hart and Tirole, 1990; McAfee and Schwartz, 1994).

[15]Non–contingency states that it is common knowledge that any breakdown in the negotiations be-

Stage 4: Market competition stage. The two rival downstream retailers compete a la Cournot in the product market. To solve this dynamic multi–stage game we evoke the *Nash–in–Nash* solution concept: the Cournot-Nash equilibrium (the non–cooperative solution of stage 2) of the asymmetric generalized Nash bargaining solution (the cooperative solution of stage 1) (Rey and Verge, 2017; Collard-Wexler et al., 2017). We also assume that the negotiated outcome of a bargaining pair is non–contingent on whether the rival pair has reached or not an agreement. In other words, we impose the negotiated agreement between $(\mathcal{R}_i, \mathcal{M})$ to be immune to a bilateral deviation of the rival's agreement.

Throughout the rest of the paper, we will make the following assumption:[16]

Assumption 1. $\beta \geq \bar{\beta}(\gamma) = \frac{\gamma^3}{(2-\gamma)(2-\gamma^2)}$

This Assumption is a sufficient and necessary condition to avoid negative profits for the upstream supplier, something that could lead to the non–existence of pairwise proof equilibria. If for a given level of product horizontal differentiation γ, the upstream's bargain power is lower than $\bar{\beta}(\gamma)$, then the supplier is subject to opportunism, being unable to subsidy his low wholesale prices via the fixed fee and thus endure negative profits, something that would violate the individual rationality condition.

Our two–characters notational convention is as follows. The first superscript denotes the Stage 1 decision of the manufacturers to merge $\mathcal{M}$ or to remain separate $\mathcal{S}$. The second superscript denotes the Stage 2 decision made by the manufacturer(s) to offer a PFVO scheme $\mathcal{P}$, or a TPT contract $\mathcal{T}$. The special case of the manufacturer(s) offering a combination of contract types to the retailers (the mixed case), has the superscript $\mathcal{X}$. As we will move to the Extensions, we will adopt an explicitly stated slightly modified notation.

---

tween $(\mathcal{R}_i, \mathcal{M})$ is non–permanent and non–irrevocable (Horn and Wolinsky, 1988). In other words, in case of a breakdown in the bargain of $(\mathcal{R}_i, \mathcal{M})$, then $(\mathcal{R}_j, \mathcal{M})$ will not renegotiate their contract terms (Milliou and Petrakis, 2007).

[16]Notice that $\bar{\beta}(\gamma)$ is increasing with γ, is concave–up, $\bar{\beta}(0) = 0$ and $\bar{\beta}(1) = 1$.

3.3 Equilibrium Analysis

3.3.1 Downstream Competition Stage

In Stage 4, independently of whether the manufacturers have merged or not as well as independently of the contract types offered by the manufacturer(s) to the retailers,[17] each $\mathcal{R}_i$ chooses its quantity q_i, taking rival q_j as given, in order to maximize its *gross* profits:[18]

$$\max_{q_i} \pi_i(q_i, q_j) = (\alpha - q_i - \gamma q_j)q_i - w_i q_i \tag{3.1}$$

This gives rise to the following reaction functions:

$$R_i(q_j, w_i) = \frac{1}{2}(\alpha - w_i - \gamma q_j) \tag{3.2}$$

A decrease in the wholesale price w_i or in products' homogeneity γ shifts the reaction function upwards and turns $\mathcal{R}_i$ into a more aggressive downstream competitor. Solving the system of the reaction functions, we get equilibrium quantities and profits for a given level of wholesale prices:

$$q_i^*(w_i, w_j) = \frac{\alpha(2 - \gamma) - 2w_i + \gamma w_j}{4 - \gamma^2} \tag{3.3}$$

$$\pi_i^*(w_i, w_j) = [q_i^*(w_i, w_j)]^2 \tag{3.4}$$

In stage 3, the manufacturer(s) and the retailers bargain over their contract terms. The bargaining game is different in the case of a merger, compared to the case of no merger, so we analyze these two cases separately.

[17] Notice that: $q_i^* = \arg\max_{q_i}[\pi_i(q_i, q_j)] = \arg\max_{q_i}[\pi_i(q_i, q_j) - F_i] = \arg\max_{q_i}[(1 - s_i)\pi_i(q_i, q_j)]$.

[18] For what follows, π_i are the $\mathcal{R}_i$'s gross profits, $\hat{\pi}_i$ are the $\mathcal{R}_i$'s net profits, while Π_i are the $\mathcal{M}_i$'s net profits. In case of merger, the upstream monopolist has net profits equal to Π.

3.3.2 Separate manufacturers

In this case, each retailer $\mathcal{R}_i$ trades with a dedicated exclusive manufacturer $\mathcal{M}_i$, forming two vertical chains in the industry: $(\mathcal{R}_i, \mathcal{M}_i)$ and $(\mathcal{R}_j, \mathcal{M}_j)$. Having in mind the two different contract types, there are four possible third–stage sub–games to consider: (a)*universal TPT:* both vertical chains trade over two–part tariff contracts (w_i, F_i), (b)*universal PFVO:* both vertical chains trade over partial forward vertical ownership schemes (w_i, s_i), and a double case (due to the ex–ante symmetry of the firms) (c) & (d)*mixed case:* one vertical chain bargains over a TPT contract while the other vertical chain bargains over a PFVO scheme. Given that the analysis of the sub–game (a) is similar to the analysis found in Milliou and Petrakis (2007), and the analysis of the sub–game (b) is similar to the analysis found in Sorensen (1992), we will analyze here only the mixed case, while the other two cases are summarized in the Appendix.

Mixed case

Without any loss of generality, we assume that the vertical chain $(\mathcal{M}_i, \mathcal{R}_i)$ bargains over a two–part tariff contract (w_i, F_i) consisting of a per–unit wholesale price w_i and a consumption–independent fixed fee F_i, while the other vertical chain $(\mathcal{M}_j, \mathcal{R}_j)$ bargains over a partial forward vertical ownership scheme (w_j, s_j) consisting of a per–unit wholesale price w_j and a profit share percentage $0 < s_j < 1$. In both cases, the contracts are offered by the manufacturers to the respective retailers based on their profit maximization process.

In particular, the vertical chain $(\mathcal{M}_i, \mathcal{R}_i)$, taking as given the equilibrium outcome of the other vertical chain, chooses (w_i, F_i) in order to maximize the following generalized asymmetric Nash product:

$$\max_{w_i, F_i} \left[\left(\pi_i^*(w_i, w_j) - F_i\right)^{1-\beta} \left((w_i - c)q_i^*(w_i, w_j) + F_i\right)^{\beta} \right] \tag{3.5}$$

At the same time, the vertical chain $(\mathcal{M}_j, \mathcal{R}_j)$, taking as given the equilibrium outcome of the first vertical chain, chooses (w_j, s_j) in order to maximize the following generalized asymmetric Nash product:

$$\max_{w_j,s_j}\left[\left((1-s_j)\pi_j^*(w_i,w_j)\right)^{1-\beta}\left((w_j-c)q_j^*(w_i,w_j)+s_j\pi_j^*(w_i,w_j)\right)^{\beta}\right] \tag{3.6}$$

Solving the system of Eq.3.5 and Eq.3.6, we obtain the equilibrium wholesale prices, fixed fee and profit share in the mixed case:

$$w_i^{\mathcal{SX}}=c-\frac{\gamma^2\tilde{\alpha}}{4-(2-\gamma)\gamma} \qquad F_i^{\mathcal{SX}}=\frac{2(2\beta+(1-\beta)\gamma^2)\tilde{\alpha}^2}{(4-(2-\gamma)\gamma)^2}$$

$$w_j^{\mathcal{SX}}=c-\frac{\gamma^2\tilde{\alpha}}{4-(2-\gamma)\gamma} \qquad s_j^{\mathcal{SX}}=\beta+\frac{1}{2}(1-\beta)\gamma^2$$

Where: $\tilde{\alpha}=\alpha-c$, with $0<\tilde{\alpha}<\alpha$. Interestingly, even though the two vertical chains use two different instruments (a fixed fee F_i versus a percentage of profits s_j), they get the same wholesale prices $w_i^{\mathcal{SX}}=w_j^{\mathcal{SX}}$, which in turn gives the same equilibrium quantities and retail prices:

$$q_i^{\mathcal{SX}}=q_j^{\mathcal{SX}}=\frac{2\tilde{\alpha}}{4-(2-\gamma)\gamma}, \quad p_i^{\mathcal{SX}}=p_j^{\mathcal{SX}}=\alpha-\frac{2(\gamma+1)\tilde{\alpha}}{4-(2-\gamma)\gamma}$$

Furthermore, notice that the two instruments (fixed fee and profit share) extract the same amount of downstream profits: $F_i^{\mathcal{SX}}=s_j^{\mathcal{SX}}\pi_j^{\mathcal{SX}}$.[19] A manufacturer with absolute bargain power $\beta=1$ will leave the retailer with zero profits since $s_i|_{\beta=1}=1$, while a manufacturer with no bargain power $\beta=0$ has to rely on product differentiation to extract some economic rents from his respective retailer since $s_i|_{\beta=0}=\frac{1}{2}\gamma^2$. For the sake of simplicity, and due to symmetry, we drop the subscripts. The following Lemma summarizes.

Lemma 18. *Under Cournot competition downstream, dedicated suppliers and mixed contract types:*

[19]The derivation of this equality with respect to w_i gives us: $\frac{\partial F_i^{\mathcal{SX}}}{\partial w_i}=\pi_j^{\mathcal{SX}}\frac{\partial s_j^{\mathcal{SX}}}{\partial w_i}+s_j^{\mathcal{SX}}\frac{\partial \pi_j^{\mathcal{SX}}}{\partial w_i}$. Notice that $\frac{\partial s_j^{\mathcal{SX}}}{\partial w_i}$ constitutes the PFVO's direct effect of w_i on F_i's profits, while $\frac{\partial \pi_j^{\mathcal{SX}}}{\partial w_i}$ constitutes the PFVO's indirect effect of w_i on F_i's profits. These two effects are equal to the TPT's direct effect of w_i on F_i's profits.

1. *Wholesale price is below marginal cost* $w^{\mathcal{SX}} < c$, *decreases as products become more homogeneous* $\frac{\partial w^{\mathcal{SX}}}{\partial \gamma} < 0$ *and is bargain power independent.*

2. *Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous* $\frac{\partial q^{\mathcal{SX}}}{\partial \gamma} < 0$ *and* $\frac{\partial p^{\mathcal{SX}}}{\partial \gamma} < 0$.

3. *Both the fixed fee and the profit share are increasing as bargain power increases* $\frac{\partial F^{\mathcal{SX}}}{\partial \beta} > 0$ *and* $\frac{\partial s^{\mathcal{SX}}}{\partial \beta} > 0$, *but they show a different behavior over the product's differentiation: profit share always increases as products become more homogeneous* $\frac{\partial s^{\mathcal{SX}}}{\partial \gamma} > 0$, *while for the fixed fee this is valid only in a specific area of the* (β, γ)*–plane* $\frac{\partial F^{\mathcal{SX}}}{\partial \gamma} > 0 \Leftrightarrow \beta < \beta_{crit} = \frac{\gamma(4+\gamma^2)}{4+\gamma^3}$.

The vertical chain will choose a bargaining power independent wholesale price to maximize the joint profits, and then it will distribute the maximized "pie"based on the bargaining power of each member of the vertical chain. In any case, the bargaining power will not affect prices or output, and consequently the fierce of the downstream competition. Product differentiation could severely affect the transference of economic rents between the members of the vertical chain, and could also affect the downstream competition: aggregate output and retail prices are lowest when products are perfect substitutes.

3.3.3 Merged manufacturers

We will now turn to the analysis of the case in which the two manufacturers have been merged, forming one common upstream monopolist, supplying both retailers. As in the previous case, we consider four possible third–stage sub–games. The analysis of the sub–game (a) is similar to the analysis found in Milliou and Petrakis (2007), and the analysis of the sub–game (b) is similar to the analysis found in Sorensen (1992), so we will analyze here only the mixed case, while the other two cases are summarized in the Appendix.

Mixed case

Without any loss of generality, we assume that the common manufacturer $\mathcal{M}$ offers to $\mathcal{R}_i$ a two–part tariff contract (w_i, F_i), and at the same time, $\mathcal{M}$ offers to $\mathcal{R}_j$ a partial forward vertical ownership scheme (w_j, s_j). The two generalized asymmetric Nash bargain products are:

$$\max_{w_i,F_i}\left[\left(\pi_i^*(w_i,w_j)-F_i\right)^{1-\beta}\left(\bar{\Pi}(w_i,w_j)+F_i+s_j\pi_j^*(w_i,w_j)-\mathcal{D}_i^{\mathcal{MX}}(w_j,s_j)\right)^{\beta}\right] \quad (3.7)$$

$$\max_{w_j,s_j}\left[\left((1-s_j)\pi_j^*(w_i,w_j)\right)^{1-\beta}\left(\bar{\Pi}(w_i,w_j)+F_i+s_j\pi_j^*(w_i,w_j)-\mathcal{D}_j^{\mathcal{MX}}(w_i,F_i)\right)^{\beta}\right] \quad (3.8)$$

where $\bar{\Pi}(w_i, w_j) = \sum_{i=1}^{2}[(w_i - c)q_i^*(w_i, w_j)]$. The upstream monopolist has an "outside option": if an agreement with one retailer is not reached, the common manufacturer will have the profits from selling a monopoly quantity to the other:

$$\mathcal{D}_i^{\mathcal{MX}}(w_j,s_j)=(w_j-c)q_j^{mon}(w_j)+s_j\pi_j^{mon}(w_j)$$

$$\mathcal{D}_j^{\mathcal{MX}}(w_i,F_i)=(w_i-c)q_i^{mon}(w_i)+F_i$$

where: $q_i^{mon}(w_i) = \frac{1}{2}(\alpha - w_i)$ and $\pi_i^{mon}(w_i) = [q_i^{mon}(w_i)]^2$ is the expected output and gross profits of a monopolist retailer facing wholesale price w_i. This disagreement payoff is familiar to the related literature (Milliou and Petrakis, 2007), and it reflects the non–contingency assumption we've made: the breakdown in one pair's negotiations will not trigger renegotiations to the other pair. Solving the system of Eq.3.7 and Eq.3.8, we get the equilibrium values of this stage:

$$w_i^{\mathcal{MX}}=c-\frac{\gamma(\beta(2-\gamma)(2-\gamma^2)-2(1-\gamma)\gamma)\tilde{\alpha}}{2(2-\gamma^2)^2}$$

$$F_i^{\mathcal{MX}}=\frac{(2-\gamma)^2(2(2-\beta^2-\beta)\gamma^2+(1-\beta)^2\gamma^4+8\beta)(4-\beta(2-\gamma^2)\gamma-(2+\gamma)\gamma^2)^2\tilde{\alpha}^2}{128(2-\gamma^2)^4}$$

$$q_i^{\mathcal{MX}}=\frac{(2-\gamma)(4-\beta(2-\gamma^2)\gamma-(2+\gamma)\gamma^2)\tilde{\alpha}}{4(2-\gamma^2)^2}$$

$$w_j^{\mathcal{MX}}=c-\frac{4-\gamma^2(\beta(2-\gamma)(2-\gamma^2)-(4-\gamma)\gamma^2)\tilde{\alpha}}{4(2-\gamma^2)^2}$$

$$q_j^{\mathcal{MX}}=\frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)},\quad s_j^{\mathcal{MX}}=\beta+\frac{1}{2}(1-\beta)\gamma^2$$

The following Lemma summarizes.

Lemma 19. *Under Cournot competition downstream, a common supplier and mixed contract types:*

1. *For the first retailer, offered the two-part tariff contract, the following hold.*

   (a) *Wholesale price is below marginal cost* $w_i^{\mathcal{MX}} < c$ *iff* $\beta < \beta_{crit}(\gamma) = \frac{2}{2-\gamma} - \frac{2}{2-\gamma^2}$, *and it increases with bargain power* $\frac{\partial w_i^{\mathcal{MX}}}{\partial \beta} > 0$.

   (b) *Quantity decrease and retail price increase with bargain power* $\frac{\partial q_i^{\mathcal{MX}}}{\partial \beta} < 0$ *and* $\frac{\partial p_i^{\mathcal{MX}}}{\partial \beta} > 0$. *Quantity decreases as products become more homogeneous* $\frac{\partial q_i^{\mathcal{MX}}}{\partial \gamma} < 0$.

   (c) *The fixed fee increases with bargain power* $\frac{\partial F_i^{\mathcal{MX}}}{\partial \beta} > 0$.

2. *For the second retailer, offered the partial forward vertical ownership scheme, the following hold.*

   (a) *Wholesale price is always below marginal cost* $w_j^{\mathcal{MX}} < c$, *and it increases with bargain power* $\frac{\partial w_j^{\mathcal{MX}}}{\partial \beta} > 0$.

   (b) *Quantity is bargain power independent, while it increases as product become more homogeneous* $\frac{\partial q_j^{\mathcal{MX}}}{\partial \gamma} > 0$ *iff* $\gamma > 0.5857$. *Retail price increases with bargain power* $\frac{\partial p_j^{\mathcal{MX}}}{\partial \beta} > 0$.

   (c) *The profit share increases with bargain power* $\frac{\partial s_j^{\mathcal{MX}}}{\partial \beta} > 0$ *and as products become more homogeneous* $\frac{\partial s_j^{\mathcal{MX}}}{\partial \gamma} > 0$.

The wholesale price of the PFVO retailer is below the wholesale price of the TPT retailer: $w_i^{\mathcal{MX}} > w_j^{\mathcal{MX}}$. Interestingly, and in contrast with the previous case, the wholesale price is bargain power dependent on both retailers. A common manufacturer with higher bargain power can effectively soften competition by increasing wholesale prices. This, in turn, will increase retail prices and will prevent retailers from entering into a price war. Aggregate quantity will be partially affected, because only $q_i^{\mathcal{MX}}$ will decrease, because $q_j^{\mathcal{MX}}$ is bargain power independent. Notice that under a common manufacturer, the following inequality hold: $F_i^{\mathcal{MX}} \leq s_i^{\mathcal{MX}} \pi_i^{\mathcal{MX}}$. The intuition behind this finding is very surprising: the common manufacturer could extract more economic rents from the retailer using the profit share instead of the fixed fee.

3.4 Merger incentives

In this section, we will state the stage 2 and stage 1 equilibria when either the supplier(s) or the retailers decide the contract types. We're doing so to better highlight the forces at work when we endogenize the contract choice. In section 3.4.1 we will follow our initial model setup of section 3.2, and in stage 2 we will allow the supplier(s) to choose the contract type to offer to the retailers. In stage 1, the suppliers will choose whether to merge and form an upstream monopolist or not. On the contrary, in section 3.4.2 we will deprive of our previously mentioned model setup, and in stage 2 we will allow the retailers to choose which contract type to offer to the supplier(s).

3.4.1 The supplier(s) decide the contracts

In this section, we follow our main model and we assume that in stage 2 it is the supplier(s) who decide the contract type. Following stage 1, the stage 2 decision could be made from either one upstream monopolist or two separate suppliers. We will examine each merger case separately. The following lemma summarizes the latter case.

Lemma 20. *When the separate upstream firms decide the contract type, all three contract types (PFVO, TPT and Mixed) are equilibria.*

The economic intuition behind this lemma is as follows. The separate suppliers achieve the same amount of profits with all three contract types, thus they have no incentives to deviate from either contract type. This occurs because the forces at work are exactly the same in all three cases: the vertical chain uses the wholesale price to maximize its joint profits and then uses either the fixed fee or the profit share to distribute the maximized joint profits between the vertical chain members, according to their bargain power. Notice that: $F^{\mathcal{S}k} = s^{\mathcal{S}k} \pi^{\mathcal{S}k}$ for all $k \in \{\mathcal{T}, \mathcal{P}, \mathcal{X}\}$. This result makes all three contract types possible equilibria. But, this is not the case when the upstream suppliers decide to merge. The following lemma summarizes the case of the upstream monopolist.

Lemma 21. *An upstream monopolist who decides the contract type, prefers a universal partial forward vertical ownership scheme.*

As we have previously shown, the use of partial forward vertical ownership eases the commitment problem and allows for lower wholesale prices and higher subsidy through the profit share.[20] A major difference in the forces at work is the following: the upstream monopolist gets a consumption–dependent profit share, and not a consumption–independent fixed fee, so it has incentives to commit to lower wholesale prices in order to increase retailers' output and through it his own profit shares. Furthermore, in the case of mixed contracts, the upstream monopolist exploits the retailer with the two–part tariff contract and sets a higher wholesale price compared to the retailer with the partial forward vertical ownership scheme, in order to protect his own profit share and indirectly subsidize from the latter for the low wholesale prices given to the former. The following proposition states the stage 1 merger decision when the supplier(s) decide the contract type.

Proposition 3.4.1. *The upstream suppliers prefer to merge and offer a universal partial forward vertical ownership scheme.*

According to proposition 3.4.1, if the suppliers are let to decide their merger status as well as the contract types to offer to the retailers, they will merge and offer a universal partial forward vertical ownership. This is in line with the relevant literature (e.g. Horn and Wolinsky (1988)), which states that in the presence of product market competition, an upstream merger is always profitable. As we show in the relevant proof in the Appendix, this result holds under any bargain distribution $0 < \beta < 1$ and any product differentiation $0 < \gamma < 1$. The intuition behind this proposition comes mainly from the fact that an

[20]Partial forward vertical ownership acts somewhat like a commitment device because it allows the upstream monopolist to extract more economic rents from the downstream retailers with the same bargain power, compared to linear and non–linear contracting.

upstream monopolist offering a universal PFVO scheme could achieve the highest wholesale price $w^{\mathcal{MP}} > w^{\mathcal{SP}} = w^{\mathcal{ST}} > w^{\mathcal{MT}}$ and thus effectively softening downstream competition, leading to a higher industry surplus in the merger case. This proposition, and the discussion thereafter, reveals that the contract types can have significant implications for the equilibrium industry structure.

3.4.2 The retailers decide the contracts

In this section, we will depart from our model and we will examine the case in which during Stage 2 the downstream retailers decide the contract types.

Lemma 22. *When the retailers decide the contract type and face separate upstream suppliers, all three contract types (PFVO, TPT, and Mixed) are equilibria.*

The economic intuition behind this result is the same as in Lemma 20. Since $F^{\mathcal{S}k} = s^{\mathcal{S}k}\pi^{\mathcal{S}k}$ for all $k \in \{\mathcal{T}, \mathcal{P}, \mathcal{X}\}$, the retailers are indifferent between the choice of any contract type. All three contract types maximize the joint profits of the vertical chain the same way, and then they distribute them to the bargain parties according to their respective bargain power. The following lemma summarizes the case of an upstream monopolist.

Lemma 23. *When the retailers decide the contract type and face an upstream monopolist, they prefer two–part tariff contracts.*

This result is the opposite of the result when the upstream monopolist decides the contract type. First, the mixed contract leads to a profit distribution between the two universal cases, so there are always incentives, no matter who decides, to deviate from this type of contract. Second, the existence of an ownership percentage works as a commitment device, allowing him to ease the downstream competition through higher wholesale prices $w^{\mathcal{MP}} > w^{\mathcal{MT}}$ and thus lower output $q^{\mathcal{MP}} < q^{\mathcal{MT}}$. This leads to higher profit extraction from the upstream monopolist to both retailers. Consequently, if the retailers are let to decide the contract type, they would choose two–part tariffs to shift their reaction functions outwards. The following proposition states the stage 1 merger decision when the retailers decide the contract type.

Proposition 3.4.2. *If the retailers choose contract types, then the upstream suppliers will not to merge.*

The result of this Proposition is in contrast to the findings of Horn and Wolinsky (1988), who state that upstream merger incentives are always present when downstream firms compete. The proposition is in line with Milliou and Petrakis (2007) who end up in a similar finding. The economic intuition behind this result is as follows. The merger creates a negative impact on the wholesale prices $w^{\mathcal{ST}} > w^{\mathcal{MT}}$, something that leads to a more fierce downstream competition, and thus to smaller industry profits. Furthermore, the existence of the outside option worsens the situation for the merged entity since the fixed fee might not be high enough to subsidize both the disagreement payoff and a wholesale price below marginal cost.

3.5 Welfare analysis

In this section, we will perform a welfare analysis, and we will discuss briefly the policy–maker's incentives to encourage (or not) a certain type of contract over the other. Social welfare *SW* is defined as the sum of the consumer surplus and firms' profits:

$$SW = CS + \sum_{i=1}^{2} \hat{\pi}_i + \Pi$$

where $CS = \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$ is the consumers' surplus[21], while $\hat{\pi}$ are the downstream net profits, and $\Pi = \sum_{i=1}^{2} \Pi_i$ under separate manufacturers. Substituting the relevant expressions into *CS* and *SW*, and after some simple algebraic manipulations, we obtain the following proposition. In a sense, the following proposition states the equilibrium when a

[21]Following Singh and Vives (1984), we obtain the consumer's surplus by substituting the inverse demand $p_i = a - q_i - \gamma q_j$ into the expression: $u(q_i, q_j) - p_i q_i - p_j q_j$.

policymakers enforces both the contract type and the merger status, based solely on the maximization of the social welfare.

Proposition 3.5.1. *1. The highest social welfare (as well as consumer surplus) is attained under merged upstream manufacturers and universal TPT contracts:* $SW^{\mathcal{MT}} > SW^{\lambda k}$ *and* $CS^{\mathcal{MT}} > CS^{\lambda k}$, $\lambda \in \{\mathcal{M}, \mathcal{S}\}$ *and* $k \in \{\mathcal{P}, \mathcal{X}\}$.

2. $SW^{\mathcal{ST}} = SW^{\mathcal{SX}} = SW^{\mathcal{SP}}$ *and* $CS^{\mathcal{ST}} = CS^{\mathcal{SX}} = CS^{\mathcal{SP}}$.

3. $SW^{\mathcal{MP}} < SW^{\mathcal{MX}} < SW^{\mathcal{MT}}$ *and* $CS^{\mathcal{MP}} < CS^{\mathcal{MX}} < CS^{\mathcal{MT}}$.

4. $SW^{\mathcal{M}k} < SW^{\mathcal{S}k}$, $SW^{\mathcal{MT}} > SW^{\mathcal{ST}}$ *and* $CS^{\mathcal{M}k} < CS^{\mathcal{S}k}$, $CS^{\mathcal{MT}} > CS^{\mathcal{ST}}$ *while* $k \in \{\mathcal{P}, \mathcal{X}\}$.

The proof of this Proposition is in the Appendix. Proposition 3.5.1 informs us that the highest social welfare, as well as the highest consumer surplus, is when the upstream manufacturers decide to merge and offer two–part tariff contracts to both downstream retailers. This is mainly driven by the fact that under one common upstream manufacturer and two–part tariffs for both retailers, wholesale price is minimum. The common manufacturer can effectively subsidize both retailers with a very low wholesale price, which in turn increases output and lowers retail prices. This competition softening strategy on behalf of the common upstream, who treats product market competition as intra–brand. Notice that this is not the case under partial forward vertical ownership schemes, because a wholesale price reduction on behalf of the common manufacturer will lead to lower profit shares and thus lower upstream net profits.

In terms of policy implication, the welfare analysis shows that a horizontal upstream merger is not always bad in terms of social welfare and consumer surplus, as long as the merged entity has no claims in the downstream profits. Furthermore, it points out that is erroneous to treat two–part tariff contracts and partial forward vertical ownership the same way. the former has no effect on the equilibrium output and prices, while the latter could distort both of them significantly. One might wonder, if, in section 3.4, we allowed the retailers to choose contract type, what would happen if a policymaker could choose the contract type that maximizes the social welfare. The following proposition summarizes.

Proposition 3.5.2. *If a policymaker could enforce a contract type, then this should be: (i)a universal TPT, if the suppliers merge or (ii)he should be indifferent between all three contracts if the suppliers remain separate.*

The proof of this proposition can be found in the Appendix. The economic intuition behind this result is as follows. If the suppliers decide to remain separate, then social welfare is the same no matter what contract type the vertical chains use. This is because both the equilibrium output $q^{\mathcal{ST}} = q^{\mathcal{SX}} = q^{\mathcal{SP}}$ and retail prices $p^{\mathcal{ST}} = p^{\mathcal{SX}} = p^{\mathcal{SP}}$ are equal. On the other hand, if the suppliers decide to merge, then under a universal PFVO the upstream monopolist could manipulate better the downstream competition leading to lower equilibrium output and higher retail prices, something that harms the social welfare and the industry profits. Thus, a policymaker aligns his interests with the downstream retailers and decides to enforce a universal TPT contract. The mixed case lies between the two universal cases, leading all market participants to deviate from it.

3.6 Bertrand competition in the product market

In the aforementioned basic model, firms compete in quantities. This is because the Cournot type competition is a better approximation of the wholesale market (Arya and Mittendorf, 2011). However, in this extension, we will consider how price competition could swift (or not) the incentives of the upstream manufacturers to merge, as well as their incentives to decide the optimal contract type. Throughout the rest of this section, we will make the following assumption:[22]

Assumption 2. $\beta > \tilde{\beta}(\gamma) = \frac{(2-\gamma)(1+\gamma)\gamma^3}{8-\gamma(1+\gamma)(4-(2-\gamma)\gamma^2)}$

This Assumption is a sufficient and necessary condition to avoid negative profits for the common upstream manufacturer under price competition in the product market. Having that in mind we must exclude the area of the (γ, β) plane which constitutes of high γ's and low β's. In this way, we avoid any unwanted non–existence of pairwise proof equilibria due to

[22] Notice that $\tilde{\beta}(\gamma)$ is increasing with γ, is concave–up, while $\tilde{\beta}(0) = 0$ and $\tilde{\beta}(1) = 1$.

the negative manufacturer's profits. The following lemma summarizes the equilibrium values per merger state and per contract type.

Lemma 24. *(A)Under Bertrand competition and dedicated manufacturers, the following equilibrium values hold.*

(i)Under Universal TPT contracts,

$$w^{\beta\mathcal{S}\mathcal{T}} = c - \frac{(1-\gamma)\gamma^2\tilde{\alpha}}{4-\gamma(2+\gamma)}, \quad q^{\beta\mathcal{S}\mathcal{T}} = \frac{(2-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))}$$
$$F^{\beta\mathcal{S}\mathcal{T}} = \frac{(1-\gamma)(2-\gamma^2)(2\beta-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))^2}$$

(ii)Under Universal PFVO schemes,

$$w^{\beta\mathcal{S}\mathcal{P}} = c - \frac{(1-\gamma)\gamma^2\tilde{\alpha}}{4-\gamma(2+\gamma)}, \quad q^{\beta\mathcal{S}\mathcal{P}} = \frac{(2-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))}, \quad s^{\beta\mathcal{S}\mathcal{P}} = \frac{2\beta-\gamma^2}{2-\gamma^2}$$

(iii)Under Mixed schemes,

$$w_i^{\beta\mathcal{S}\mathcal{X}} = w_j^{\beta\mathcal{S}\mathcal{X}} = c - \frac{(1-\gamma)\gamma^2\tilde{\alpha}}{4-\gamma(2+\gamma)}, \quad q_i^{\beta\mathcal{S}\mathcal{X}} = q_j^{\beta\mathcal{S}\mathcal{X}} = \frac{(2-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))}$$
$$s_i^{\beta\mathcal{S}\mathcal{X}} = \frac{2\beta-\gamma^2}{2-\gamma^2}, \quad F_j^{\beta\mathcal{S}\mathcal{X}} = \frac{(1-\gamma)(2-\gamma^2)(2\beta-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))^2}$$

(B)Under Bertrand competition and one common manufacturer, the following equilibrium values hold.

(i)Under Universal TPT contracts,

$$w^{\beta\mathcal{M}\mathcal{T}} = c + \frac{1}{4}\gamma^2\tilde{\alpha}, \quad q^{\beta\mathcal{M}\mathcal{T}} = \frac{(2+\gamma)\tilde{\alpha}}{4(1+\gamma)}$$
$$F^{\beta\mathcal{M}\mathcal{T}} = \frac{(2+\gamma)(\beta(4-2\gamma-\gamma^3+\gamma^4)-\gamma^2(2-\gamma+\gamma^2))\tilde{\alpha}}{32(1+\gamma)}$$

(ii)Under Universal PFVO schemes,

$$w^{\beta\mathcal{MP}} = c + \frac{\gamma(\beta(2-\gamma)(4-\gamma(2-(1-\gamma)\gamma)) + \gamma(4-\gamma(8-(3-\gamma)\gamma)))\tilde{\alpha}}{4(1-\gamma)(\beta(2-\gamma)(1+\gamma)\gamma + \gamma^3 - \gamma^2 + 4)}$$
$$q^{\beta\mathcal{MP}} = \frac{(8-\gamma(4-\gamma(\beta(2-(5-\gamma)\gamma) - (3-\gamma)(2-\gamma))))\tilde{\alpha}}{4(1-\gamma^2)(4+\beta(2-\gamma)(1+\gamma)\gamma + \gamma^3 - \gamma^2)}$$
$$s^{\beta\mathcal{MP}} = \frac{2\beta(4+\gamma^4-\gamma^3-2\gamma) - 2\gamma^2(2-(1-\gamma)\gamma)}{8-\gamma(4+\gamma((3-\gamma)(2-\gamma) - \beta(2-(5-\gamma)\gamma)))}$$

(iii)Under Mixed schemes, the equilibrium values are too complex to be stated here.[23]

In contrast to the Cournot competition, the wholesale prices under universal TPT and universal PFVO are above the marginal cost $c > 0$. This is due to the upward sloping reaction functions in Bertrand style competition. The intuition behind this result is the following. When F_i reduces his retail price p_i, it is in the best interest of rival F_j to reduce p_j as well. Given the fact that wholesale and retail prices are positive correlated $\frac{\partial p}{\partial w} > 0$, this could extinguish the manufacturer's profits. To avoid this, the manufacturer has to restrict downstream competition by agreeing on a wholesale price above the marginal cost. This has an impact on the quantities sold. Wholesale prices, except the $\beta\mathcal{MP}$ case, are bargain power independent because they are used to maximize joint profits (O'Brien and Shaffer, 1992). In the $\beta\mathcal{MP}$ case, it seems that the vertical chains are unable to maximize joint profits and for this reason, the common upstream is willing to exert his bargain power over the determination of the wholesale price in order to increase the exploitation of the downstream profits. Under separate upstream manufacturers, wholesale price always increase as product become more homogeneous $\frac{\partial w^{\beta Sk}}{\partial \gamma} > 0$, $k \in \{T, P, \mathcal{M}\}$. Furthermore, notice that $w^{\beta\mathcal{MP}} > c \Leftrightarrow \beta > \beta_B(\gamma)$, which is inside the permissible area of the Assumption 1.[24] Finally, $0 < s^{\beta\mathcal{MP}} < 1$ for all β, γ within the area marked in the Assumption 1. Unfortunately, the equilibrium values of the mixed case under one common upstream manufacturer are too long to state here. The following Proposition summarizes the equilibrium contracts and merger status under Bertrand

[23]The equilibrium values of the mixed case under Bertrand competition and one common upstream manufacturer are available upon request.

[24]$\beta_{\mathcal{M}}(\gamma) = 1 + \frac{4(1+\gamma^2)}{4+\gamma(2-(1-\gamma)\gamma)} - \frac{4}{2-\gamma}$ while $\forall \beta, \gamma \in (0,1) : \beta_{\mathcal{M}}(\gamma) > \bar{\beta}(\gamma)$.

competition in the product market.

Proposition 3.6.1. *(A)Under Bertrand competition in the product market and two dedicated upstream manufacturers, firms are indifferent between Universal PFVO, Universal TPT, and Mixed contracts.*

(B)Under one common upstream manufacturer, the Universal TPT is the contract equilibrium for low bargain power and intermediate product differentiation $\tilde{\beta}(\gamma) < \beta < \beta_T(\gamma)$ *(Area I of Figure 3.2), while the Universal PFVO is the contract equilibrium for low product differentiation* $\beta > \beta_T(\gamma)$ *(Area II of Figure 3.2).*

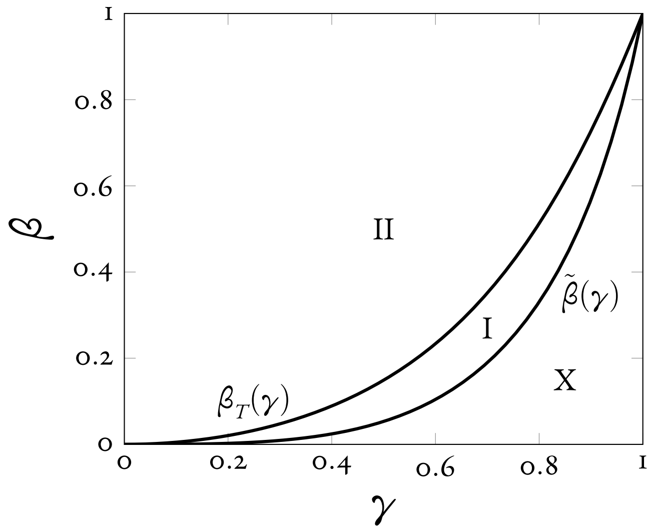


Figure 3.2: Equilibria under Bertrand competition.

Proposition 3.6.1 states that under endogenous contracts, and under dedicated suppliers, all contracts have the same equilibrium values in prices, quantities, and profits for all market participants. The intuition behind this result is the same as in the Cournot case explained above. When the upstream market is not monopolized by a single manufacturer, there is an equivalence between PFVO and TPT contracts. On the contrary, when both retailers trade with one single common upstream manufacturer, both the Universal TPT and the Universal PFVO could be optimal, but for a different distribution of the bargaining power and the product differentiation. Clearly, as the bargaining power increases, the upstream monopolist could extract more economic rents from the downstream market through PFVO schemes compared to the TPT contracts. This is due to the existence of the indirect effect of the wholesale price on retailers' profits, a unique aspect of the PFVO schemes which is absent from the TPT contracts.

Using the social welfare formula and analysis stated in section 3.5, and after some algebraic manipulations, it is easy to show that: $\forall \beta, \gamma \in (0,1) : SW^{\beta \mathcal{ST}} = SW^{\beta \mathcal{SX}} = SW^{\beta \mathcal{SP}}$ and $CS^{\beta \mathcal{ST}} = CS^{\beta \mathcal{SX}} = CS^{\beta \mathcal{SP}}$. On the other hand, and under the restriction of the Assumption 2, the following inequality holds: $SW^{\beta \mathcal{MT}} < SW^{\beta \mathcal{MP}} \Leftrightarrow \beta < \beta_Z(\gamma)$.[25] This shows that if the policy maker could exogenously enforce a contract type, he should consider greatly the manufacturer's bargain power as well as the product differentiation. It seems that for intermediate β's and γ's the socially optimal contract type is the Universal PFVO, while for low γ's but high β's the socially optimal contract is the Universal TPT. The same reasoning applies if we allow the retailers to choose contract types. It seems that no matter what the competition mode is, the downstream firms share the same incentives with the policy maker and in contrast to the upstream firm(s). The following proposition states the Stage 1 equilibria (manufacturers' merger decision) under Bertrand competition in the product market.

Proposition 3.6.2. *Under Bertrand competition in the product market, the manufacturers will always decide to merge.*

Proposition 3.6.2 states that, under the restrictions of the Assumption 2, the upstream manufacturers will decide to merge in both Areas I and II. The intuition behind this result is the following. Due to the exclusion of Area X, in which the common manufacturer suffers from negative profits, bargain power is either medium (Area I) or low (Area II). In these two Areas, the separate manufacturers suffer from low input subsidization, which leads them to merge. Interestingly, and under the restriction of the Assumption 2, under one common upstream manufacturer, the mixed case is never an equilibrium because F_j has always incentives to deviate. The use of PFVO between F_i and M

[25] $\beta_Z(\gamma) = 1 - \frac{2(2-\gamma^2-\gamma)}{4+\gamma^4-\gamma^3-2\gamma}$.

3.7 Conclusions

Upstream horizontal mergers draw a lot of attention from the regulatory agencies for many reasons. It is not only the impact on the final consumers and their welfare but also we have to consider the impact on the profitability and employment of the firms supplied by the merged entity. Even if downstream horizontal mergers are widely believed as socially unattractive, the same does not hold for the upstream mergers.

In our paper, we continue some previous attempts to endogenize the contract type decision and to link it with the upstream merger status (Milliou and Petrakis, 2007). We allow the upstream firms to endogenize the decision to merge and to offer either two–part tariff contracts or partial forward vertical ownership schemes to their downstream retailers, either under quantity of price competition in the product market. In line with Horn and Wolinsky (1988), we show that manufacturers will always decide to merge horizontally. Under Cournot competition in the product market, the common upstream finds optimal to offer PFVO schemes to both retailers. Under Bertrand competition, the same scheme is offered only for a very specific range of bargain power and product differentiation. For the last type of competition mode, and for a different range of β's and γ's, it is possible for the common upstream monopolist to offer TPT to both retailers as well. In any case, and in contrast to Milliou and Petrakis (2007), merger incentives do not depend on either the bargaining power nor the product differentiation.

Regarding the welfare implications of our research, we should note that, under downstream Cournot competition, the maximum social welfare is attained for merged upstream manufacturers offering two–part tariff contracts to both retailers. Under downstream Bertrand competition, the maximum welfare is attained, again, for merged upstream firms but the socially optimal contract depends heavily on the bargain power distribution. In any case, the mixed regime (in which firms offered different types of contracts) is never an equilibrium, neither for the upstream firms nor for the policymaker. If we allow the downstream firms to decide the contract type, they mimic the decision of the policymaker, a result with obvious policy–implications. The following Table summarizes.

	Cournot Competition		Bertrand Competition	
	Common $\mathcal{M}$	Dedicated $\mathcal{M}_i$	Common $\mathcal{M}$	Dedicated $\mathcal{M}_i$
Upstream Firms Decide the Contracts				
PFVO	X	X	$\beta > \beta_Z(\gamma)$	X
TPT		X	$\tilde{\beta}(\gamma) < \beta < \beta_Z(\gamma)$	X
Downstream Firms Decide the Contracts				
PFVO		X	$\tilde{\beta}(\gamma) < \beta < \beta_Z(\gamma)$	X
TPT	X	X	$\beta > \beta_Z(\gamma)$	X
Policy–Makers Decide the Contracts				
PFVO		X	$\tilde{\beta}(\gamma) < \beta < \beta_Z(\gamma)$	X
TPT	X	X	$\beta > \beta_Z(\gamma)$	X

Table 3.1: Equilibria of contract type decision.

Our findings lead to a number of testable implications. First, the use of two–part tariffs and partial forward vertical ownership schemes in sectors with dedicated upstream suppliers should be equal. This should remain the same no matter if the downstream firms compete in prices or quantities. On the contrary, in economic sectors with Cournot competition and upstream monopolists, the latter schemes should prevail in using the former type of contract. This situation should be bargain power dependent when firms compete in prices.

3.8 Appendix

3.8.1 Universal TPT

A. Separate manufacturers

Both separate manufacturers offer two–part tariff contracts to their respective retailers. Taken as given the outcome of the simultaneously–run negotiations over the same type of contract of the rival pair, vertical chain $(\mathcal{M}_i, \mathcal{R}_i)$ chooses (w_i, F_i) in order to maximize the following generalized asymmetric Nash bargain product:

$$\max_{w_i, F_i} \left[\left(\pi_i^*(w_i, w_j) - F_i \right)^{1-\beta} \left((w_i - c) q_i^*(w_i, w_j) + F_i \right)^{\beta} \right]$$

Solving the first–order conditions (Milliou and Petrakis, 2007), and invoking the equilibrium symmetry (thus we drop the subscripts), we get:

$$w^{ST} = c - \frac{\gamma^2 \tilde{\alpha}}{4 - (2-\gamma)\gamma} \qquad q^{ST} = \frac{2\tilde{\alpha}}{4 - (2-\gamma)\gamma}$$
$$p^{ST} = \alpha - \frac{2(1+\gamma)\tilde{\alpha}}{4 - (2-\gamma)\gamma} \qquad F^{ST} = \frac{2(2\beta + (1-\beta)\gamma^2)\tilde{\alpha}^2}{(4 - (2-\gamma)\gamma)^2}$$

Wholesale price is below marginal cost, is bargain power independent, and it decreases as products become more homogeneous. Quantity and retail price are bargain power independent, and they both decrease as products become more homogeneous. Fixed fee increases with bargain power, and decreases as products become more homogeneous if and only if $\beta > \beta_{crit} = \frac{\gamma(4+\gamma^2)}{4+\gamma^3}$.

B. Merged manufacturers

A common upstream manufacturer offers the same two–part tariff contract to both retailers. The two bargains take place simultaneously and separately, and the common upstream manufacturer has a non-contingent positive outside option. Following the standard procedure, bargain pair $(\mathcal{M}, \mathcal{R}_i)$ chooses (w_i, s_i) in order to maximize the following generalized asymmetric Nash bargain product:

$$\max_{w_i,F_i}\Big[\big(\pi_i^*(w_i,w_j)-F_i\big)^{1-\beta}\Big(\sum_{i=1}^{2}[(w_i-c)q_i^*(w_i,w_j)+F_i]-(w_j-c)q_j^{mon}(w_j)-F_j\Big)^{\beta}\Big]$$

Solving the first–order conditions (Milliou and Petrakis, 2007), and invoking the equilibrium symmetry, we get:

$$w^{\mathcal{MT}}=c-\frac{\gamma^2\tilde{\alpha}}{2(2-\gamma^2)}\qquad q^{\mathcal{MT}}=\frac{(2-\gamma)\tilde{\alpha}}{2(2-\gamma^2)}$$

$$p^{\mathcal{MT}}=\alpha-\frac{(2-\gamma)(1+\gamma)\tilde{\alpha}}{2(2-\gamma^2)}\qquad F^{\mathcal{MT}}=\frac{(2-\gamma-2)^2(2\beta+(1-\beta)\gamma^2)\tilde{\alpha}^2}{8(2-\gamma^2)^2}$$

Notice that the wholesale price is below marginal cost and also below the wholesale price under separate manufacturers $\forall\beta,\gamma\in(0,1):w^{\mathcal{MT}}<w^{\mathcal{ST}}<c$. Furthermore, wholesale price is bargain power independent, and it decreases as products become more homogeneous. On the other hand, compared to the case of separate manufacturers, quantity is higher while retail price is lower $\forall\beta,\gamma\in(0,1):q^{\mathcal{MT}}>q^{\mathcal{ST}}$ and $p^{\mathcal{MT}}<p^{\mathcal{ST}}$. Both are bargain power independent, and decrease as products become more homogeneous. A common manufacturer is able to extract a higher fixed fee compared to a dedicated manufacturer $\forall\beta,\gamma\in(0,1):F^{\mathcal{MT}}>F^{\mathcal{ST}}$. Finally, fixed fee increases with bargain power.

3.8.2 Universal PFVO

A. Separate manufacturers

Both separate manufacturers offer partial forward vertical ownership schemes to their respective retailers. Taken as given the outcome of the simultaneously–run negotiations over the same type of contract of the rival pair, vertical chain $(\mathcal{M}_i,\mathcal{R}_i)$ chooses (w_i,s_i) in order to maximize the following generalized asymmetric Nash bargain product:

$$\max_{w_i,s_i}\Big[\big((1-s_i)\pi_i^*(w_i,w_j)\big)^{1-\beta}\big((w_i-c)q_i^*(w_i,w_j)+s_i\pi_i^*(w_i,w_j)\big)^{\beta}\Big]$$

Solving the first–order conditions (Sorensen, 1992), and invoking the equilibrium symmetry, we get:

$$w^{\mathcal{SP}} = c - \frac{\gamma^2\tilde{\alpha}}{4-(2-\gamma)\gamma} \qquad q^{\mathcal{SP}} = \frac{2\tilde{\alpha}}{4-(2-\gamma)\gamma}$$
$$p^{\mathcal{SP}} = \alpha - \frac{2(1+\gamma)\tilde{\alpha}}{4-(2-\gamma)\gamma} \qquad s^{\mathcal{SP}} = \beta + \frac{1}{2}(1-\beta)\gamma^2$$

Notice that when the manufacturers are separate, the equilibrium values of the universal TPT are the same as the equilibrium values of the universal PFVO. Furthermore, the following equality holds: $F^{\mathcal{ST}} = s^{\mathcal{SP}}\pi^{\mathcal{SP}}$. The equivalence between TPT and PFVO under separate manufacturers is obvious.

B. Merged manufacturers

A single manufacturer (upstream monopolist), offers the same partial forward ownership scheme to both retailers. The two bargains take place simultaneously and separately, and the common upstream manufacturer has a non-contingent positive outside option. Following the standard procedure, bargain pair $(\mathcal{M}, \mathcal{R}_i)$ chooses (w_i, s_i) in order to maximize the following generalized asymmetric Nash bargain product:

$$\max_{w_i,s_i} \Big[\big((1-s_i)\pi_i^*(w_i,w_j)\big)^{1-\beta}\Big(\sum_{i=1}^{2}[(w_i-c)q_i^*(w_i,w_j)+s_i\pi_i^*(w_i,w_j)]-$$
$$-(w_j-c)q_j^{mon}(w_j)-s_i\pi_j^{mon}(w_j)\Big)^{\beta}\Big]$$

Solving the first–order conditions (Sorensen, 1992), and invoking the equilibrium symmetry, we get:

$$w^{\mathcal{MP}} = c - \frac{\gamma(\gamma(4-\gamma(4+\gamma))-\beta(8-\gamma^2(4+\gamma)))\tilde{\alpha}}{16-2\gamma(6\gamma-(2+\gamma)((1-\beta)\gamma^2+2\beta))}$$
$$q^{\mathcal{MP}} = \frac{(2-\gamma)(4-(1-\beta)\gamma^2)\tilde{\alpha}}{16-2\gamma(6\gamma-(2+\gamma)((1-\beta)\gamma^2+2\beta))}$$
$$p^{\mathcal{MP}} = \alpha - \frac{(2-\gamma)(1+\gamma)(4-(1-\beta)\gamma^2)\tilde{\alpha}}{16-2\gamma(6\gamma-(2+\gamma)((1-\beta)\gamma^2+2\beta))} \qquad s^{\mathcal{MP}} = \frac{4(2+\beta)}{4-(1-\beta)\gamma^2} - 2$$

Notice that if a common manufacturer chooses to offer a PVFO contract, then the wholesale price will be bargain power dependent, and through it the competition mode. An increase in the common manufacturer's bargain power will cause an increase in the wholesale price $\frac{w^{\mathcal{MP}}}{\partial\beta} > 0$, a decrease in output $\frac{q^{\mathcal{MP}}}{\partial\beta} < 0$ and an increase in the retail price $\frac{p^{\mathcal{MP}}}{\partial\beta} > 0$. These forces at work soften competition and harm social welfare. This difference is the driving factor behind the non–equivalence of two–part tariffs and partial forward vertical ownership under a common upstream firm.

3.8.3 Proofs of Propositions

Proof. Lemma 20. The equilibrium upstream net profits under separate upstream suppliers and all the alternative contract types are:

$$\Pi^{\mathcal{SP}} = \Pi^{\mathcal{ST}} = \Pi_i^{\mathcal{SX}} = \Pi_j^{\mathcal{SX}} = \frac{2\beta(2-\gamma^2)\tilde{\alpha}^2}{(4+(2-\gamma 2)\gamma)^2}$$

Due to the equilibrium symmetry, we have dropped the subscripts for the universal PVFO and the universal TPT cases. It is quite obvious that there is no unilateral profitable deviation from any contract type to another. Thus, under separate suppliers, all 3 contract types (PVFO, TPT, Mixed) are equilibria. □

Proof. Lemma 21. The equilibrium upstream net profits under one merged upstream monopolist and all the alternative contract types are:

$$\Pi^{\mathcal{MP}} = \frac{(2-\gamma)(4-(1-\beta)\gamma^2)(\beta(8+\gamma(4-\gamma(4+\gamma(2+\gamma))))+\gamma^3(\gamma+2))\tilde{\alpha}^2}{2(\gamma((\gamma+2)((\beta-1)\gamma^2-2\beta)+6\gamma)-8)^2}$$

$$\Pi^{\mathcal{MT}} = \frac{(2-\gamma)(\beta(2-\gamma)(2-\gamma^2)-\gamma^3)\tilde{\alpha}^2}{4(2-\gamma^2)^2}$$

$$\Pi^{\mathcal{MX}} = \frac{(2-\gamma)\tilde{\alpha}^2}{128(2-\gamma^2)^4}[(\gamma-2)(-2(\beta^2+\beta-2)\gamma^2+(1-\beta)^2\gamma^4+8\beta)(\beta(\gamma^2-2)\gamma-$$

$$-(2+\gamma)\gamma^2+4)^2+16(\gamma^2-2)\gamma^2(\beta(2-\gamma)(2-\gamma^2)+(4-\gamma)\gamma^2-4)-$$

$$-16\gamma(\beta(2-\gamma)(2-\gamma^2)+2(\gamma-1)\gamma)(\beta(\gamma^2-2)\gamma-(2+\gamma)\gamma^2+4)-$$

$$-32(2-\gamma)(2-\gamma^2)^2(\beta+\frac{1}{2}(1-\beta)\gamma^2)]$$

Under the limitations of the Assumption 1, it can be readily verified that: $\Pi^{\mathcal{MP}} > \Pi^{\mathcal{MX}}$ while $\Pi^{\mathcal{MT}} < \Pi^{\mathcal{MX}}$, so the sole equilibrium contract type under an upstream monopolist is the universal PFVO scheme. Furthermore, notice that $\Pi^{\mathcal{MT}} < \Pi^{\mathcal{MP}}$. □

Proof. Proposition 3.4.1. The extensive form of the first two stages of the decision game described in section 3.2 are presented in the following tree diagram. Using the upstreams' net profit functions described in the proofs of the previous Lemmata, and after some algebraic manipulations, we get: $\Pi^{\mathcal{MT}} < \Pi^{\mathcal{MX}} < \Pi^{\mathcal{MP}}$ while $\Pi^{\mathcal{ST}} = \Pi^{\mathcal{SX}} = \Pi^{\mathcal{SP}}$ and $2\Pi^{\mathcal{SP}} < \Pi^{\mathcal{MP}}$, so the upstream firms will choose to merge and offer a universal PFVO scheme to both retailers. □

Proof. Lemma 22. The equilibrium downstream net profits $\hat{\pi}$ are:

$$\hat{\pi}^{\mathcal{ST}} = \hat{\pi}^{\mathcal{SP}} = \hat{\pi}_i^{\mathcal{SX}} = \hat{\pi}_j^{\mathcal{SX}} = \frac{2(1-\beta)(2-\gamma^2)\tilde{\alpha}^2}{(4+(2-\gamma)\gamma)^2}$$

It is quite obvious that there is no unilateral profitable deviation from any contract type to another. Thus, under separate suppliers, all 3 contract types (PVFO, TPT, Mixed) are equilibria. □

Proof. Lemma 23. The equilibrium downstream net profits $\hat{\pi}$ are:

$$\hat{\pi}^{\mathcal{MT}} = \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}, \quad \hat{\pi}^{\mathcal{MP}} = \frac{(1-\beta)(2-\gamma)^2(4-3\gamma^2)(4-(1-\beta)\gamma^2)\tilde{\alpha}^2}{4(8-\gamma(6\gamma-(2+\gamma)((1-\beta)\gamma^2+2\beta)))^2}$$

$$\hat{\pi}_i^{\mathcal{MX}} = \frac{(2-\gamma)^2\tilde{\alpha}^2}{128(2-\gamma^2)^4}[(4-\beta(2-\gamma^2)\gamma-(2+\gamma)\gamma^2)^2(8(1-\beta)-2(2-\beta^2-\beta)\gamma^2-$$

$$-(1-\beta)^2\gamma^4)], \quad \hat{\pi}_j^{\mathcal{MX}} = \frac{(1-\beta)(2-\gamma)^2\tilde{\alpha}^2}{8(2-\gamma^2)}$$

Under the non–negativity Assumption 1, and after some algebraic manipulations it can be verified that: $\hat{\pi}^{\mathcal{MT}} > \hat{\pi}_i^{\mathcal{MX}}$ while $\hat{\pi}_j^{\mathcal{MX}} > \hat{\pi}^{\mathcal{MP}}$ and $\hat{\pi}^{\mathcal{MT}} > \hat{\pi}^{\mathcal{MP}}$. □

Proof. Proposition 3.4.2. Based on the Lemmata 22 and 23, if the retailers have to choose contract types in stage 2, then: (a)if they face an upstream monopolist they will choose a universal TPT contract, or (b)if they face separate suppliers they are indifferent between all three contract types. Consequently, having in mind the Assumption 1 and after some algebraic manipulations, it is easy to show that: $\Pi^{\mathcal{MT}} < 2\Pi^{\mathcal{ST}} = 2\Pi^{\mathcal{SP}} = 2\Pi_i^{\mathcal{SX}} = 2\Pi_j^{\mathcal{SX}}$, so the suppliers having in mind the game continuity and the decision of the retailer on stage 2, will choose not to merge. □

Proof. Proposition 3.5.1. Substituting the relevant expressions of output into $CS(q_i, q_j) = \frac{1}{2}(q_i^2 + q_j^2 + 2\gamma q_i q_j)$ we get the consumer surplus under different merger cases and contract types. To obtain the social welfare, we substitute into the following type the relevant expressions of net profits per case: $SW(q_i, q_j) = CS(q_i, q_j) + \hat{\pi}_i(q_i, q_j) + \hat{\pi}_j(q_i, q_j) + \Pi(q_i, q_j)$ where $\Pi(q_i, q_j) = \Pi_i(q_i, q_j) + \Pi_j(q_i, q_j)$ if the manufacturers remain separate.

2. It can readily verified that $\forall \beta, \gamma \in (0, 1)$ the following equalities hold: $SW^{\mathcal{ST}} = SW^{\mathcal{SX}} = SW^{\mathcal{SP}}$ and $CS^{\mathcal{ST}} = CS^{\mathcal{SX}} = CS^{\mathcal{SP}}$.

3. Using some simple algebraic manipulations, it is easy to show that $\forall \beta, \gamma \in (0, 1)$ the following inequalities hold: $SW^{\mathcal{MP}} < SW^{\mathcal{MX}} < SW^{\mathcal{MT}}$ and $CS^{\mathcal{MP}} < CS^{\mathcal{MX}} < CS^{\mathcal{MT}}$.

4. It can readily verified that $\forall \beta, \gamma \in (0, 1)$ the following inequalities hold: $SW^{\mathcal{M}k} < SW^{\mathcal{S}k}, \quad SW^{\mathcal{MT}} > SW^{\mathcal{ST}}$ and $CS^{\mathcal{M}k} < CS^{\mathcal{S}k}, \quad CS^{\mathcal{MT}} > CS^{\mathcal{ST}}$ while $k \in \{\mathcal{P}, \mathcal{X}\}$.

1. From (2), (3) and (4) we get that the highest level of social welfare, as well as consumer surplus, can be attained under merged upstream manufacturers and universal TPT contracts.

□

Proof. Proposition 3.5.2. A policy–maker should choose the contract type that maximizes social welfare. (i)if the suppliers decide to merge, then as in the proof of the proposition 3.5.1 it can readily verified that $\forall\beta, \gamma \in (0,1)$ the following inequality holds: $SW^{\mathcal{MP}} < SW^{\mathcal{MT}}$. (ii)if the suppliers remain separate, then using simple algebraic manipulations, it is easy to show that $\forall\beta, \gamma \in (0,1)$ the following inequality holds: $SW^{\mathcal{ST}} = SW^{\mathcal{SX}} = SW^{\mathcal{SP}}$. □

Proof. Lemma 24 Assume the linear demand function: $q_i(p_i, p_j) = \frac{\alpha}{1+\gamma} - \frac{1}{1-\gamma^2}p_i + \frac{\gamma}{1-\gamma^2}p_j$, and price competition in the product market, which is characterized by the following equations: $\max_{p_i}[\pi_i(p_i, p_j)] \Rightarrow p_i^*(p_j) = \frac{1}{2}(\alpha(1-\gamma) + w_i + \gamma p_j)$. Following the standard procedure, we get: $p_i^*(w_i, w_j) = \frac{\alpha(2-\gamma^2-\gamma)+2w_i+\gamma w_j}{4-\gamma^2}$. We will analyze the cases of two dedicated manufacturers and one common manufacturer separately. We will start our analysis with the case of the two separate manufacturers.

■ *Separate suppliers*

Universal TPT: We model the generalized asymmetric Nash bargain product as follows:

$$[\pi_i^*(w_i, w_j) - F_i]^{1-\beta}[(w_i - c)q_i^*(w_i, w_j) + F_i]^\beta$$

Following the standard maximizing procedure, we get:

$$w^{\mathcal{ST}} = c + \frac{(1-\gamma)\gamma^2\tilde{\alpha}}{4-\gamma(2+\gamma)}, \quad q^{\mathcal{ST}} = \frac{(2-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))}, \quad p^{\mathcal{ST}} = \alpha - \frac{(2-\gamma^2)\tilde{\alpha}}{4-\gamma(2+\gamma)}$$

Universal PFVO: We model the generalized asymmetric Nash bargain product as follows:

$$[(1-s_i)\pi_i^*(w_i, w_j)]^{1-\beta}[(w_i - c)q_i^*(w_i, w_j) + s_i\pi_i^*(w_i, w_j)]^\beta$$

Following the standard maximizing procedure, we get:

$$w^{\mathcal{SP}} = c + \frac{(1-\gamma)\gamma^2\tilde{\alpha}}{4-\gamma(2+\gamma)}, \quad q^{\mathcal{SP}} = \frac{(2-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))}, \quad p^{\mathcal{SP}} = \alpha - \frac{(2-\gamma^2)\tilde{\alpha}}{4-\gamma(2+\gamma)}$$

which are the same as in the Universal TPT case.

Mixed Case: We model the two different generalized asymmetric Nash bargain products as follows:

$$[(1-s_i)\pi_i^*(w_i,w_j)]^{1-\beta}[(w_i-c)q_i^*(w_i,w_j)+s_i\pi_i^*(w_i,w_j)]^\beta$$
$$[\pi_j^*(w_i,w_j)-F_j]^{1-\beta}[(w_j-c)q_j^*(w_i,w_j)+F_j]^\beta$$

Following the standard maximizing procedure, we get:

$$w_i^{\mathcal{SX}} = w_j^{\mathcal{SX}} = c + \frac{(1-\gamma)\gamma^2\tilde{\alpha}}{4-\gamma(2+\gamma)}, \quad q_i^{\mathcal{SX}} = q_j^{\mathcal{SX}} = \frac{(2-\gamma^2)\tilde{\alpha}}{(1+\gamma)(4-\gamma(2+\gamma))}$$
$$p_i^{\mathcal{SX}} = p_j^{\mathcal{SX}} = \alpha - \frac{(2-\gamma^2)\tilde{\alpha}}{4-\gamma(2+\gamma)}$$

which are the same as in the Universal TPT and the Universal PFVO cases. In all three cases, notice that the wholesale price is bargain power independent and is above the marginal cost. For intermediate and low product differentiation $\gamma < 0.7780$ the wholesale price increases with γ, while the opposite holds for higher product differentiation values. We will now move to the case of on common upstream supplier.

■ *Common supplier*

Universal TPT: We model the generalized asymmetric Nash bargain product as follows:

$$[\pi_i^*(w_i,w_j)-F_i]^{1-\beta}[\Pi^{\mathcal{MT}}(w_i,w_j,F_i,F_j)-(w_j-c)q_j^m(w_j)-F_j]^\beta$$

where: $\Pi^{\mathcal{MT}}(w_i,w_j,F_i,F_j) = \sum_{i=1}^{2}(w_i-c)q_i^*(w_i,w_j)+F_i$ are $\mathcal{M}$'s profits, while $q_j^m(w_j)$ is the monopoly output realized by $\mathcal{R}_j$ in the case of a (non–permanent and non–irrevocable) breakdown in the negotiations between $\mathcal{R}_i$ and $\mathcal{M}$. Following the standard procedure, we get:

$$w^{\mathcal{MT}} = c + \frac{1}{4}\gamma^2\tilde{\alpha}, \quad q^{\mathcal{MT}} = \frac{(\gamma+2)\tilde{\alpha}}{4(\gamma+1)}, \quad p^{\mathcal{MT}} = \alpha - \frac{1}{4}(2+\gamma)\tilde{\alpha}$$

In contrast to the Cournot competition, wholesale price is above marginal cost, and it increases as products become more homogeneous $\frac{\partial w^{\mathcal{MT}}}{\partial \gamma} > 0$. Quantity and retail price are bargain power independent, while the fixed fee increases with bargain power $\frac{\partial F^{\mathcal{MT}}}{\partial \beta} > 0$. Quantity, retail price and fixed fee are always decreasing when products become more homogeneous $\frac{\partial p^{\mathcal{MT}}}{\partial \gamma} < 0$ and $\frac{\partial q^{\mathcal{MT}}}{\partial \gamma} < 0$ and $\frac{\partial F^{\mathcal{MT}}}{\partial \gamma} < 0$.

Universal PFVO: The generalized asymmetric Nash bargain product is:

$$[(1-s_i)\pi_i^*(w_i,w_j)]^{1-\beta}[\Pi^{\mathcal{MT}}(w_i,w_j,s_i,s_j) - (w_j - c)q_j^m(w_j) - s_j(q_j^m(w_j))^2]^\beta$$

where: $\Pi^{\mathcal{MT}}(w_i,w_j,F_i,F_j) = \sum_{i=1}^{2}(w_i - c)q_i^*(w_i,w_j) + s_i\pi_i^*(w_i,w_j)$. Following the standard procedure, we get:

$$\begin{aligned} w^{\mathcal{MT}} &= c - \frac{\gamma(\beta(\gamma-2)(\gamma((\gamma-1)\gamma+2)-4) - \gamma(\gamma((\gamma-3)\gamma+8)-4))\tilde{\alpha}}{4(1-\gamma)(\beta(\gamma-2)(\gamma+1)\gamma - \gamma^3 + \gamma^2 - 4)} \\ q^{\mathcal{MT}} &= \frac{(\gamma(\gamma(\beta((\gamma-5)\gamma+2) - (\gamma-3)(\gamma-2)) - 4) + 8)\tilde{\alpha}}{4(\gamma^2-1)(\beta(\gamma-2)(\gamma+1)\gamma - \gamma^3 + \gamma^2 - 4)} \\ p^{\mathcal{MT}} &= \alpha - \frac{(\gamma(\gamma(\beta((\gamma-5)\gamma+2) - (\gamma-3)(\gamma-2)) - 4) + 8)\tilde{\alpha}}{4(\gamma-1)(\beta(\gamma-2)(\gamma+1)\gamma - \gamma^3 + \gamma^2 - 4)} \end{aligned}$$

Mixed Case: The two different generalized asymmetric Nash bargain products are:

$$[(1-s_i)\pi_i^*(w_i,w_j)]^{1-\beta}[\Pi^{\mathcal{MT}}(w_i,w_j,s_i,s_j) - (w_j - c)q_j^m(w_j) - s_j(q_j^m(w_j))^2]^\beta$$
$$[\pi_i^*(w_i,w_j) - F_i]^{1-\beta}[\Pi^{\mathcal{MT}}(w_i,w_j,F_i,F_j) - (w_j - c)q_j^m(w_j) - F_j]^\beta$$

Unfortunately, due to the complexity of the expressions, we are unable to state them here. In any case, they are available upon request. □

Proof. Proposition 3.6.1. Based on the analysis and reasoning of lemma 24, the equilibrium net profits for all the market participants are the following.

$$\hat{\pi}^{\beta\mathcal{ST}} = \hat{\pi}^{\beta\mathcal{SP}} = \hat{\pi}^{\beta\mathcal{SX}} = \frac{2(1-\beta)(1-\gamma)(2-\gamma^2)\tilde{\alpha}^2}{(1+\gamma)(4-\gamma(2+\gamma))^2}$$

$$\hat{\pi}^{\beta\mathcal{MP}} = \frac{(\beta-1)(\gamma+2)(\gamma(\gamma^2+\gamma-4)+4)\tilde{\alpha}^2}{16(\gamma^2-1)(\beta(-\gamma^2+\gamma+2)\gamma+(\gamma-1)\gamma^2+4)^2}(8+\gamma(\gamma(\beta((\gamma-5)\gamma+ +2)-(\gamma-3)(\gamma-2))-4))$$

$$\hat{\pi}^{\beta\mathcal{MT}} = \frac{(1-\beta)(2+\gamma)(4+\gamma^4-\gamma^3-2\gamma)\tilde{\alpha}^2}{32(1+\gamma)}$$

$$\Pi^{\beta\mathcal{ST}} = \Pi^{\beta\mathcal{SP}} = \Pi^{\beta\mathcal{SX}} = \frac{2\beta(1-\gamma)(2-\gamma^2)\tilde{\alpha}^2}{(1+\gamma)(4-\gamma(2+\gamma))^2}$$

$$\Pi^{\beta\mathcal{MP}} = \frac{(\beta-1)(\gamma+2)(\gamma(\gamma^2+\gamma-4)+4)\tilde{\alpha}^2}{16(\gamma^2-1)(\beta(-\gamma^2+\gamma+2)\gamma+(\gamma-1)\gamma^2+4)^2}(8+\gamma(\gamma(\beta((\gamma-5)\gamma+ +2)-(\gamma-3)(\gamma-2))-4))$$

$$\Pi^{\beta\mathcal{MT}} = \frac{(2+\gamma)((\beta-1)\gamma^4-(\beta-1)\gamma^3-2\beta\gamma+4\beta)\tilde{\alpha}^2}{16(1+\gamma)}$$

It is obvious that in the separate upstream firms case, either the retailers or the manufacturers are indifferent between any of the three available contract types. For the upstream merger case, and having in mind the restriction of the Assumption 2, it can be readily verified that $\forall\beta,\gamma \in (0,1)$ the following inequality holds: $\Pi^{\beta\mathcal{MP}} > \Pi^{\beta\mathcal{MT}} \Leftrightarrow \beta < \beta_Z(\gamma) = 1 - \frac{2(2-\gamma^2-\gamma)}{4+\gamma^4-\gamma^3-2\gamma}$. □

Proof. Proposition 3.6.2. With respect to the game's continuity and the restrictions of the Assumption 2, the manufacturers will merge in both Areas I and II of the Figure 3.2 because:

For β's and γ's in Area I of the Figure 3.2: For the two separate manufacturers, all three contract types are equilibria. For the one common manufacturer, the only equilibrium is the Universal TPT contract. The following inequality holds: $\forall\beta,\gamma \in$ *Area I*, $\Pi^{\beta\mathcal{MT}} > 2\Pi^{\beta\mathcal{ST}} = 2\Pi^{\beta\mathcal{SP}} = 2\Pi^{\beta\mathcal{SX}}$. So, in Area I, the manufacturers will decide to merge.

For β's and γ's in Area II of the Figure 3.2: For the two separate manufacturers, all three contract types are equilibria. For the one common manufacturer, the only equilibrium is the Universal PFVO scheme. The following inequality holds: $\forall\beta,\gamma \in$ *Area II*, $\Pi^{\beta\mathcal{MP}} > 2\Pi^{\beta\mathcal{SP}} = 2\Pi^{\beta\mathcal{ST}} = 2\Pi^{\beta\mathcal{SX}}$. So, in Area II, the manufacturers will merge. □

References

Aliprantí, M., C. Milliou, and E. Petrakis (2014). Price vs. quantity competition in a vertically related market. *Economics Letters 124*, 122–126.

Anderson, S. and M. Devereux (1989). Profit-sharing and optimal labour contracts. *Canadian Journal of Economics 22*, 425–433.

Arya, A. and B. Mittendorf (2011). Disclosure standards for vertical contracts. *RAND Journal of Economics 42*, 595–617.

Bensaid, B. and R. J. Gary-Bobo (1991). Negotiations of profit-sharing contracts in industry. *European Economic Review 35*, 1069–1085.

Bhargava, S. and T. Jenkinson (1995). Explicit versus implicit profit–sharing and the determination of wages: microeconomic evidence from the UK. *Labour 9*, 73–95.

Binmore, K., A. Rubinstein, and A. Wolinsky (1986). The Nash bargaining solution in economic modeling. *RAND Journal of Economics 17*, 176–188.

Blasi, J., R. Freeman, and D. Kruse (2016). Do broad–based employee ownership, profit sharing and stock options help the best firms do even better? *British Journal of Industrial Relations 54*, 55–82.

Brandenburger, A. and E. Dekel (1993). Hierarchies of beliefs and common knowledge. *Journal of Economic Theory 59*, 189–198.

Bronfenbrenner, K. and T. Juravich (2001). *Rekindling the movement: Labor's quest for relevance in the 21st century*. Ithaca, New York: ILR Press.

Bryson, A. (2014). Union wage effects: What are the economic implications of union wage bargaining for workers, firms and society? *IZA World of Labor Working Paper 35*.

Bryson, A., A. Clark, R. B. Freeman, and C. P. Green (2016). Share capitalism and worker wellbeing. *Labour Economics 42*, 151–158.

Bulow, J., J. Geanakoplos, and P. Klemperer (1985). Multimarket oligopoly: strategic substitutes and strategic complements. *Journal of Political Economy 93*, 441–463.

Cahuc, P. and B. Dormont (1997). Profit–sharing: does it increase productivity and employment? a theoretical model and empirical evidence on French micro data. *Labour Economics 4*, 293–319.

Carey, S. (2016). Americal airlines reverses course on employee profit–sharing. *Wall Street Journal* https://www.wsj.com/articles/american-airlines-reverses-course-on-employee-profit-sharing-1458769727 (accessed March 15th, 2018).

Chen, Y. (2001). On vertical mergers and their competitive effects. *RAND Journal of Economics 32*, 667–685.

Collard-Wexler, A., G. Gowrisankaran, and R. S. Lee (2017). "Nash–in–Nash" bargaining: a microfoundation for applied work. *Working Paper*.

De Cremer, D. and T. Tao (2015). Huawei: a case study of when profit sharing works. *Harvard Business Review* https://hbr.org/2015/09/huawei-a-case-study-of-when-profit-sharing-works (accessed March 15th, 2018).

de Fontenay, C. C. and J. S. Gans (2005). Vertical integration in the presence of upstream competition. *RAND Journal of Economics 36*, 544–572.

Dhillon, A. and E. Petrakis (2002). A generalized wage rigidity result. *International Journal of Industrial Organization 20*, 285–311.

Ellguth, P., H. D. Gerner, and J. Stegmaier (2014). Wage effects of works councils and opening clauses: The German case. *Economic and Industrial Democracy 35*, 95–113.

European Commission (2010). Guidelines on Vertical Restrains. Technical report, Brussels.

Fang, T. (2016). Profit sharing: Consequences for workers. *IZA World of Labor*.

Fung, K. C. (1989). Unemployment, profit-sharing and Japan's economic success. *European Economic Review 33*, 783–796.

Furmston, M., G. J. Tolhurst, and E. Milk (2010). *Contract Formation: Law and Practise*. New York: Oxford University Press.

Goeddeke, A. (2010). Strategic profit sharing in a unionized oligopoly. *Working Paper, Ruhn-University of Bochum*.

Hansson, B., U. Johanson, and K.-H. Leitner (2004). The impact of human capital and human capital investments on company performance. Evidence from literature and European survey results. In P. Descy and M. Tessaring (Eds.), *Evaluation and impact of education and training: the value of learning. Third report on vocational training research in Europe: synthesis report*, Chapter 6, pp. 264–319. Luxembourg: Office for Official Publications of the European Communities (Cedefop Series, 54).

Hart, O. and J. Tirole (1990). Vertical integration and market foreclosure. *Brookings Papers on Economic Activity; Microeconomics*, 205–276.

Haucap, J. and C. Wey (2004). Unionization structures and innovation incentives. *Economic Journal 114*, 149–165.

Horn, H. and A. Wolinsky (1988). Bilateral monopolies and incentives for mergers. *RAND Journal of Economics 19*, 408–419.

Hübler, O. and W. Meyer (2000). Industrial relations and the wage differentials between skilled and unskilled blue-collar workers within establishments: An empirical analysis with data of manufacturing firms. *IZA Discussion paper series no. 176*.

Kato, T., J. H. Lee, and R. J.-S. (2010). The productivity effects of profit sharing, employee ownership, stock option and team incentive plans: evidence from Korean panel data. *IZA Discussion paper series no. 5111*.

Kato, T. and M. Morishima (2003). The nature, scope and effects of profit sharing in Japan: evidence from new survey data. *The International Journal of Human Resource Management 14*, 942–955.

Katz, M. L. (1988). Some remarks on the use of observable contracts as precommitments with special reference to trade policy. *University of California at Berkeley Working Papers*.

Katz, M. L. (1991). Game-playing agents: unobservable contracts as precommitments. *RAND Journal of Economics 22*, 307–328.

Kraft, K. and M. Ugarkovic (2005). Profit sharing and the financial performance of firms: Evidence from Germany.

Kruse, D. L. (1992). Profit-sharing and productivity: Microeconomic evidence from the United States. *Economic Journal 102*, 24–36.

Liu, Q. and X. H. Wang (2014). Private and social incentives for vertical contract disclosure. *Managerial and Decision Economics 35*, 567–573.

Long, R. L. and T. Fang (2012). Do employees profit from profit sharing? evidence from Canadian panel data. *IZA Discussion paper series no. 6749*.

Lorenzetti, L. (2016). American airlines is starting a profit-sharing program for employees. *Fortune Magazine* https://fortune.com/2016/03/24/american-airlines-profit-sharing/ (accessed March 15th, 2018).

Manasakis, M. and E. Petrakis (2009). Union structure and firms' incentives fo cooperative R&D investments. *Canadian Journal of Economics 42*, 665–693.

Marotta-Wugler, F. (2012). Does contracts disclosure matter? *Journal of Institutional and Theoretical Economics 168*, 94–119.

Marx, L. and G. Shaffer (2007). Upfront payments and exclusion in downstream markets. *RAND Journal of Economics 38*, 823–843.

McAfee, P. and M. Schwartz (1994). Opportunism in multilateral vertical contracting: nondiscrimination, exclusivity, and uniformity. *American Economic Review 84*, 210–230.

McAfee, P. and M. Schwartz (1995). The non-existence of pairwise-proof equilibrium. *Economics Letters 49*, 239–255.

Milliou, C. and E. Petrakis (2007). Upstream horizontal mergers, vertical contracts, and bargaining. *International Journal of Industrial Organization 25*, 963–987.

Muller, J. (2017). A big pay day for auto workers as Ford, Chrysler share the wealth. *Forbes Magazine* https://www.forbes.com/sites/joannmuller/2017/01/26/a-big-pay-day-for-auto-workers-as-ford-chrysler-share-the-wealth (accessed March 15th, 2018).

O'Brien, D. P. and G. Shaffer (1992). Vertical control with bilateral contracts. *RAND Journal of Economics 23*, 299–308.

OECD (1995). Profit sharing in OECD countries. *OECD Employment Outlook*, 139–169.

Office of Fair Trading (2004). Vertical agreements. Understanding competition law. Technical report, London.

Oswald, A. (1982). The microeconomic theory of the trade union. *The Economic Journal 92*, 576–595.

Pontusson, H. J. (2013). Unionization, inequality and redistribution. *British Journal of Industrial Relations 51*, 797–825.

Rey, P. (2012). Vertical restraints; an economic perspective. *Working Paper*.

Rey, P. and J. E. Stiglitz (1988). Vertical restraints and producers' competition. *European Economic Review 32*, 561–568.

Rey, P. and J. Tirole (2006). A primer on foreclosure. In M. Armstrong and R. Porter (Eds.), *Handbook of Industrial Organization*, Volume 3, Chapter 33. Amsterdam: North-Holland.

Rey, P. and T. Verge (2004). Bilateral control with vertical contracts. *RAND Journal of Economics 35*, 728–746.

Rey, P. and T. Verge (2008). Economics of vertical restraints. In P. Buccirossi (Ed.), *Handbook of Antitrust Economics*, Chapter 9, pp. 353–390. Cambridge, Massachusetts: MIT Press.

Rey, P. and T. Verge (2017). Secret contracting in multilateral relations. *Working Paper*.

Schwartz, A. and R. E. Scott (2007). Precontractual liability and preliminary agreements. *Harvard Law Review 120*, 661–706.

Sesil, J., M. Kroumova, J. Blasi, and D. Kruse (2002). Broad-based employee stock options in US 'New Economy' firms. *British Journal of Industrial Relations 40*, 273–294.

Shaffer, G. (2005). Slotting allowances and optimal product variety. *Advances in Economic Analysis & Policy 5*.

Singh, N. and X. Vives (1984). Price and quantity competition in a differentiated duopoly. *RAND Journal of Economics 15*, 546–554.

Sklivas, S. D. (1987). The strategic choice of managerial incentives. *RAND Journal of Economics 18*, 452–458.

Sorensen, J. R. (1992). Profit-sharing in a unionized Cournot duopoly. *Journal of Economics 55*, 151–167.

Soskice, D. (1990). Wage determination: the changing role of institutions in advanced industrialized countries. *Oxford Review of Economic Policy 6*, 36–61.

Steward, G. (1989). Profit–sharing in Cournot oligopoly. *Economics Letters 31*, 221–224.

Svejnar, J. (1986). Bargaining power, fear of disagreement, and wage settlements: Theory and evidence from U.S. industry. *Econometrica 54*, 1055–1078.

Thanassoulis, J. and H. Smith (2009). Bargaining between retailers and their suppliers. In A. Ezrachi and U. Bernitz (Eds.), *Private Labels, Brands and Competition Policy: The Changing Landscape of Retail Competition*. Oxford University Press.

Tracy, J. (1986). Unions and the share economy. *Journal of Comparative Economics 10*, 433–437.

Vickers, J. (1985). Delegation and the theory of the firm. *Economic Journal 95*, 138–147.

Visser, J. (2006, January). Union membership statistics in 24 countries. *Monthly Labor Review*, 38–49.

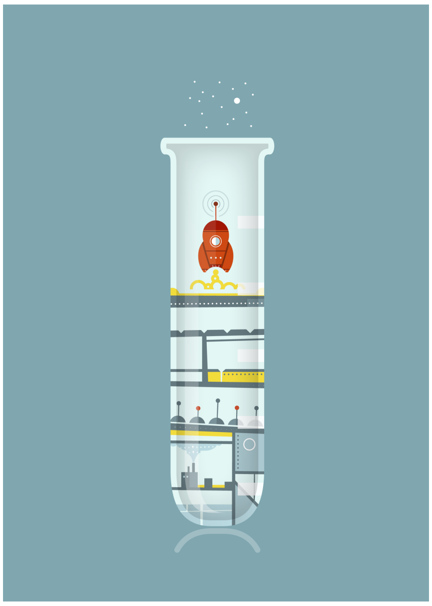
Weeden, R., E. Carberry, and S. Rodrick (1998). *Current Practices in Stock Option Plan Design*. Oakland, California: National Center for Employee Ownership.

Weitzman, M. L. (1983). Some macroeconomic implications of alternative compensation systems. *Economic Journal 93*, 763–783.

Weitzman, M. L. (1984). *The share economy: conquering stagflation*. Cambridge, Massachusetts: Harvard University Press.

Weitzman, M. L. (1985). The simple macroeconomics of profit-sharing. *American Economic Review 75*, 937–953.

Weitzman, M. L. (1987). Steady state unemployment under profit-sharing. *Economic Journal 97*, 85–105.



This thesis was typeset using LaTeX, originally developed by Leslie Lamport and based on Donald Knuth's TeX. The body text is set in 11 point Egenolff-Berner Garamond, a revival of Claude Garamont's humanist typeface. The above illustration, *Science Experiment 02*, was created by Ben Schlitter and released under CC BY-NC-ND 3.0. A template that can be used to format a PhD dissertation with this look & feel has been released under the permissive AGPL license, and can be found online at github.com/suchow/Dissertate or from its lead author, Jordan Suchow, at suchow@post.harvard.edu.