ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF ARTS AND SOCIAL SCIENCES

DOES AIRCRAFT FUEL HEDGING MAKE ECONOMIC SENSE?

EVIDENCE FROM THE U.S. MAJOR PASSENGER AIRLINES

M.Sc. THESIS

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ SOSYAL BİLİMLER ENSTİTÜSÜ

UÇAK YAKITI RİSKİNE KARŞI KULLANILAN RİSKTEN KORUNMA TEDBİRLERİ İKTİSADİ OLARAK ANLAMLI MI? AMERİKANIN BÜYÜK YOLCU HAVAYOLU ŞİRKETLERİ ÜZERİNE BİR ÇALIŞMA

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HAZİRAN 2013

Mahmut Sami GÜNGÖR, a M.Sc. student of ITU Graduate School of Arts and Social Sciences student ID 412101012, successfully defended the thesis entitled "**DOES AIRCRAFT FUEL HEDGING MAKE ECONOMIC SENSE? EVIDENCE FROM THE U.S. MAJOR PASSENGER AIRLINES**", which he prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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Date of Submission : 03 May 2013

Date of Defense : 07June 2013

To my family,

FOREWORD

I thank my thesis advisor, Assoc. Prof. Dr. Ahmet Duran, for his guidance, support and advice. Without his guidance and vision it would have been much difficult to complete this thesis. I have learned a lot from him in doing research.

I also thank to my family for constantly supporting me. I dedicate this thesis to my family.

Finally, I thank The Scientific and Technological Research Counsil of Turkey (TÜBİTAK) supporting me during my graduate studies.

May 2013, Mahmut Sami Güngör

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ABBREVIATON

ASM : Available Seat Mile
ATA: Air Transport Association of America
DOT : Department of Transportation
IATA: International Air Transport Association
RITA: Research and Innovative Technology Administration
SEC : Securities and Exchange Commission

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DOES AIRCRAFT FUEL HEDGING MAKE ECONOMIC SENSE? EVIDENCE FROM THE U.S. MAJOR PASSENGER AIRLINES

SUMMARY

We investigated the aircraft fuel hedging behavior of the U.S. major passenger airlines during the periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011. One of the goals of this study is to analyze whether airlines' aircraft fuel hedging strategies affect firms' values for such time horizons. Besides, we evaluated the relation between firms' values and the percentage of next year's fuel requirements hedged.

Firms' values were measured by the simple approximation of Tobin's Q, developed by Chung and Pruitt (1993). The natural logarithm of Tobin's Q was used as an explained variable. We also used different measures of aircraft fuel hedging activities, including the percentage of next year's fuel requirements hedged and the hedging dummy variable that received a value of 1 if the airline hedges its aircraft fuel exposure and 0 if it does not. Along with, we added various other control variables in our analysis, firm size, measured by the natural logarithm of total assets, a dividend dummy, the ratio of long term debt to total assets, the ratio of net income to total assets, and the ratio of capital expenditures to sales.

We used audited annual reports that taken from the Securities and Exchange Commission (SEC) 10-K filings in order to obtain both financial and operating data as of 31 December for the period 2002 to 2011. We searched manually over 130 annual reports and their amendments for the period 2002 to 2011 to obtain airlines' financial and operating data and hedging information that compiled from the footnotes. Moreover, the market value of common stock figures were taken from the Bloomberg database.

Then, we tested the fixed effect model versus the pooled OLS and the random effects models. The fixed effect model versus the pooled OLS is tested via an F-test. To decide between the fixed or random effects we run a Hausmant test for each model. According to the Hausman test, all models should be estimated by using the fixed effects methodology out of the second model. Its Hausman test statistic χ^2 was negative. Schreiber (2008) showed that the Hausman chi-square test statistic may be negative not only in small samples but even asymtotically as well. On the other hand, the fixed effect model was preferred to the pooled OLS with respect to the F-tests for all models. The fixed effects model is a suitable specification if we are concentrate a specific set of N firms and our inference limited to the behavior of these set of firm (Baltagi, 2001). In line with Baltagi (2001), the second model was also estimated by using the fixed effect methodology. In addition that we perfomed the time effect tests for each time horizon to determine whether we include year dummy in our models or not to control for the posibility of systematic time effects on airline's firm value.That is to say, we determined whether the one-way error component regression model is valid by testing time effect. After identifying the probable models, we also tested the

groupwise heteroskedasticity, autocorrelation and cross-sectional dependence. In accordance with these tests' results, all models were estimated with fixed effect methodology with Driscoll-Kraay standart errors by using STATA 11.

We found weak and statistically insignificant relation between hedging dummy and firm value for all periods except the period of 2007-2011. Consistent with Jin and Jorion (2006), hedging has no perceptible effect on firm value for the U.S. major passenger airlines. However, hedging with aircraft fuel exposure with derivatives shows negative and statistically significant at the 10% level during the period of 2007-2011. Airlines that prefer to use aircraft fuel hedging with derivatives have on average a 11.28% lower value premium than airlines that do not prefer to use them for this time period.

The estimated coefficients for the percentage of next year's fuel requirements hedged are positive and statistically significant at the 5% level for the periods of 2002-2011 and 2006-2011. However, the coefficients are at least positive but statistically insignificant for the periods of 2007-2011 and 2008-20011. In the case of Model 1, the coefficent of 0.2598 can be explained by declaring that an airline that hedges 100% of its aircraft fuel requirements would be anticipated to have value premium of virtually 26% over an airline hedges non of its aircraft fuel requirements. The average percentage of next year's aircraft fuel requirements hedged was 34.78% during the period 2002-2011. Hence, for those airlines in our sample, on average hedging airline displays a value premium of nearly 9%. The value premium is 7.34%, 3.99% and 4% for periods of 2006-2011, 2007-2011 and 2008-2011, respectively.

Although the hedging discount was valid with hedging dummy for the period of 2007-2011, the hedging premium results were documented with the next year's aircraft fuel requirements variable for the same period. At first glance, the results of two different hedging variables seem to contradict. However, this is not the case. If they had not hedged their fuel expense, their firm value would have been decreased more than the actual situation. For instance, the hedging discount was approximately -11% for the period of 2007-2011. Had they not used any hedging instruments, this percentage would have been lower than -11%.

On the other hand, the dynamic models were estimated by adding lagged dependent variable among the regressors in order to incorporate possible effects of the previous year's firm value. All dynamic models were estimated by using the fixed effects methodology with Driscoll-Kraay standart errors and time effects dummy. If the time dummies are not jointly significant, we excluded them from the models.

Similar to previous models, we documented negative but weak and statistically insignificant relation between hedging dummy and firm value over all periods out of the period of 2008-2011. These results resemble to the outcome of the previous models and are consistent with Jin and Jorion (2006). On the contrary, there is a positive and statistically significant relationship between hedging dummy and firm value at the 1% level for the period of 2008-2011 consistent with the Allayannis and Weston (2001) and Carter et al. (2003, 2006). According to the results, those airlines in our sample that prefer to use aircraft fuel hedging with derivatives have on average a 7% higher value premium than those that do not prefer to use them over the period of 2008-2011.

The estimated coefficients for the percentage of next year's fuel requirements hedged are positive and statistically significant at the 5% level for the periods of 2002-2011 and 2006-2011. However, the coefficients are at least positive but statistically insignificant for the periods of 2007-2011 and 2008-20011. In the case of Model9, the coefficent of 0.2676 can be interpreted by declaring that an airline that hedges 100% of its aircraft fuel requirements would be anticipated to have value premium of almost 26% over an airline hedges non of its aircraft fuel requirements. The average percentage of next year's fuel requirements hedged was 34.78% during the period 2002-2011. Hence, for those airlines in our sample, on average, an airline displays a value premium of around 9.30% [0.2676*0.3478] by implemeting hedging strategies. The value premium is 6.13%, 2.94% and 6.72% for periods of 2006-2011, 2007-2011 and 2008-2011, respectively.

UÇAK YAKITI RİSKİNE KARŞI KULLANILAN RİSKTEN KORUNMA TEDBİRLERİ İKTİSADİ OLARAK ANLAMLI MI? AMERİKANIN BÜYÜK YOLCU HAVAYOLU ŞİRKETLERİ ÜZERİNE BİR ÇALIŞMA

ÖZET

Amerika'nın büyük yolcu hava yolu şirketlerinin maruz kaldıkları uçak yakıtı riskine karşı riskten korunma davranışlarını 2002-2011, 2006-2011, 2007-2011 ve 2008-2011 dönemlerinde inceledik. Çalışmayı farklı dönemlerde yapmamızın sebebi örneklemimizde olan bazı firmaların değişik dönemlerde yeniden yapılanma sürecine girmeleridir. Firmalar söz konusu süreçte özel şartlara tabi oldukları için ilgili dönemlerde karşılaştırılabilir sağlıklı veriler bulunmamaktadır. Bu çalışmanın amaçlarından bir tanesi havayolu şirketlerinin uçak yakıtı riskine karşı uyguladıkları riskten korunma stratejilerinin ilgili dönemlerde firma değerlerini etkileyip etkilemediğidir. Ayrıca, riskten korunma yöntemleriyle gelecek yılın yakıt gereksiniminin yüzde kaçının korunduğu ile firma değeri arasındaki ilişkiyi araştırdık.

Bağımlı değişkenimiz Chung ve Pruitt'in 1993 yılında önerdiği Tobin'in Q'sunun basit yaklaşık hesaplanmasıdır. Riskten korunma faaliyetlerini ölçmek için iki ölçü kullandık. İlki, gelecek yılın yakıt gereksiniminin yüzde kaçının riskten korunduğudur. Diğeri ise, riskten korunma faaliyeti ile ilgili gölge değişkendir. İlgili dönemde herhangi bir türev ürün kullanılarak riskten korunma stratejisi belirlenmişse söz konusu gölge değişken 1 değerini, belirlenmemişse 0 değerini aldı. Bunlara ek olarak, firma değerini etkileyebilecek bazı değişkenleri kontrol değişkeni olarak modelimize dahil ettik. Söz konusu kontrol değişkenleri; firma büyüklüğü, firmanın ilgili dönemlerde temettü dağıtıp dağıtmadığı, uzun vadeli borçların toplam varlıklara oranı, net gelirin toplam varlıklara oranı ve sermaye harcamalarının satışlara oranı şeklinde sıralanabilir.

Çalışmada kullanılan finansal ve operasyonel verileri Menkul Kıymetler ve Borsa Komisyon'nundan (SEC) alınan şirketlere ait yıllık denetim raporu olan 10-K dosyalarından elde ettik. Yaklaşık 130 denetim raporunu ve varsa değişiklik raporlarını manuel olarak inceleyerek gerekli veri setini oluşturduk. Ayrıca adi hisse senetlerinin piyasa değerlerini Bloomberg veri tabanından çektik.

Sabit etkiler modelini havuzlanmış en küçük kareler ve rassal etkiler modellerine karşı test ettik. Sabit etkiler modelini havuzlanmış en küçük kareler modeline karşı F-testi yaparak rassal etkiler modeline karşı ise Hausman testi yaparak inceledik. Hausman testi sonucuna göre ikinci model dışındaki tüm modellerin sabit etkiler yöntemi ile tahmin edilmesi gerektiği sonucu vardık. İkinci modelin ki-kare test istatistiği negatif çıktı. Schreiber 2008 yılında Hausman ki-kare test istatistiğinin sadece küçük örneklemlerde değil asimptotik olarak da negatif çıkabileceğini göstermiştir. F-testi sonucuna göre tüm modeller için sabit etkiler yöntemi havuzlanmış en küçük kareler yöntemine tercih edilmiştir. Buna ek olarak, gözlenemeyen zaman etkilerini kontrol etmek için zaman gölge değişkenin modele dahil edilip edilmemesi hususunda zaman etkileri testi yaptık. Muhtemel modelleri

tanımladıktan sonra, birimlere göre heteroskedasite, otokorelasyon ve birimler arası korelasyon testlerini tüm modeller üzerinde uyguladık. Bu testlerin sonuçları doğrultusunda, tüm modeller Driscoll-Kraay standart hataları ile sabit etkiler yöntemine göre STATA 11 ekonometri programında tahmin edildi.

2007-2011 dönemi haricinde diğer tüm dönemler için riskten korunma gölge değişkeni ile firma değeri arasında zayıf ve istatistiksel olarak anlamsız bir ilişki bulduk. Jin ve Jorion'un 2006 yılındaki çalışmasıyla tutarlı olarak, söz konusu dönemde Amerika'nın büyük yolcu havayolu şirketleri için riskten korunma tedbirleri ile firma değerleri arasında elde tutulur bir ilişki bulunamamıştır. Ancak, 2007-2011 döneminde söz konusu örneklem için incelen ilişki negatif ve 10% seviyesinde istatistiksel olarak anlamlıdır. İlgili dönem ve örneklemde, türev ürünlerini kullanarak yakıt riskinden korunmayı tercih eden havayolu firmaları tercih etmeyenlere nazaran ortalama olarak 11.28% daha düşük değer primine sahip olacaklardır.

Diğer taraftan, gelecek yılın yakıt gereksiniminin yüzde kaçının riskten korunduğunu gösteren değişkenin tahmin edilen katsayısı 2002-2011 ve 2006-2011 dönemleri için pozitif ve istatistiksel olarak anlamlıdır. Model 1'e baktığımızda, ilgili katsayı 0.2598 şöyle yorumlanabilir; gelecek senenin yakıt gereksiniminin tamamını türev ürünler ile riskten koruyan havayolu şirketleri türev ürünleri ile herhangi bir koruma yapmayan havayolu şirketlerine nazaran yaklaşık 26% değer primine sahip olacaklardır. 2002-2011 döneminde gelecek senenin yakıt gereksiniminin 34.78% lik bölümü türev ürünleri ile riskten korunmuştur. Böylece, söz konusu dönem ve örneklem için ortalama olarak 9% değer priminden bahsedebiliriz [0.2598*34.78%]. Değer primi 2006-2011, 2007-2011 ve 2008-2011 dönemleri için sırasıyla 7.34%, 3.99% ve 4% dir.

İlk bakışta, iki farklı ana değişken ile tahmin edilen farklı modellerin sonuçlarının bir biri ile çeliştiği şeklinde bir algı oluşabilir. Ancak, söz konusu firmaların herhangi bir riskten korunma aracı kullanmadıklarında durumları şimdikinden daha kötü olabilir. Örnek vermek gerekirse 2007-2008 dönemi için tahmin edilen modelde riskten korunma faaliyetlerine atfedilen değer değişmesi -11% dir. Şayet bu firmalar maruz kaldıkları risklere karşı herhangi bir şey yapmasalardı değer değişimi muhtemelen -11%'den daha düşük olacaktı.

Diğer taraftan, geçmiş dönem firma değerinin bir sonraki dönem firma değerine muhtemel etkilerini modele dahil etmek için modele bağımlı değişkenin bir dönemlik gecikmeli değerini dahil ederek daha önceki modelleri dinamik hale getirdik. Tüm dinamik modelleri zaman gölge değişkenlerini de dahil ederek dengeli panel sabit etkiler yöntemi ile tahmin ettik. Zaman gölge değişkenleri müştereken anlamlı değil ise söz konusu değişkenleri modelden çıkardık.

Daha önce tahmin ettiğimiz modellere benzer şekilde 2008-2011 dönemi haricinde firma değeri ve riskten korunma gölge değişkeni arasında negatif ve istatistiksel olarak anlamsız bir ilişkiyi bulguladık. Jin ve Jorion'un 2006 yılındaki çalışmasıyla tutarlı olarak, söz konusu dönemde Amerika'nın büyük yolcu havayolu şirketleri için riskten korunma tedbirleri ile firma değerleri arasında elde tutulur bir ilişki bulunamamıştır. Diğer taraftan, 2008-2011 döneminde söz konusu örneklem için incelen ilişki pozitif ve 1% seviyesinde istatistiksel olarak anlamlıdır. İlgili dönem ve örneklemde, türev ürünlerini kullanarak yakıt riskinden korunmayı tercih eden havayolu firmaları tercih etmeyenlere nazaran ortalama olarak 7% daha yüksek değer primine sahip olacaklardır.

Diğer taraftan, gelecek yılın yakıt gereksiniminin yüzde kaçının riskten korunduğu değişkeninin tahmin edilen katsayısı 2002-2011 ve 2006-2011 dönemleri için pozitif ve 5% seviyesinde istatistiksel olarak anlamlıdır. Model 1'e baktığımızda, ilgili katsayı 0.2676 şöyle yorumlanabilir; gelecek senenin yakıt gereksiniminin tamamını türev ürünler ile riskten koruyan havayolu şirketleri türev ürünleri ile herhangi bir koruma yapmayan havayolu şirketlerinden yaklaşık 26% değer primine sahip olacaklardır. 2002-2011 döneminde gelecek senenin yakıt gereksiniminin 34.78% lik bölümü türev ürünleri ile riskten korunmuştur. Böylece, söz konusu dönem ve örneklem için ortalama olarak 9.30% değer priminden bahsedebiliriz [0.2676*34.78%]. Değer primi 2006-2011, 2007-2011 ve 2008-2011 dönemleri için sırasıyla 6.13%, 2.94% ve 6.72% dir.

1. INTRODUCTION

According to the Oxford Economic study, Economic Benefits from Air Transport in the US, published by IATA in May 2012, the aviation sector provided $669.5 billion in gross added value which is 4.9 percent of the U.S. economy. Of this, $206.4 billion came directly from airlines, airports and related ground services. Thus, U.S. airlines are considered to be indispensable facilitators of the U.S. economy.However, they have constantly faced sudden cost increase from rising aircraft fuel prices. According to the Air Transportation of America (ATA), aircraft fuel is an airline's second largest cost following the labor cost. As shown in Figure 1.1, the percentage of fuel costs in operating expense have continuously raised until the year of 2008 for the U.S. major passenger airlines. Approximately 36% of operating expense came from aircraft fuel cost in 2008. It has increased from virtually 13% to 35%. If this increasing trend keeps on in future, the aircraft fuel cost will be dominant cost factor.

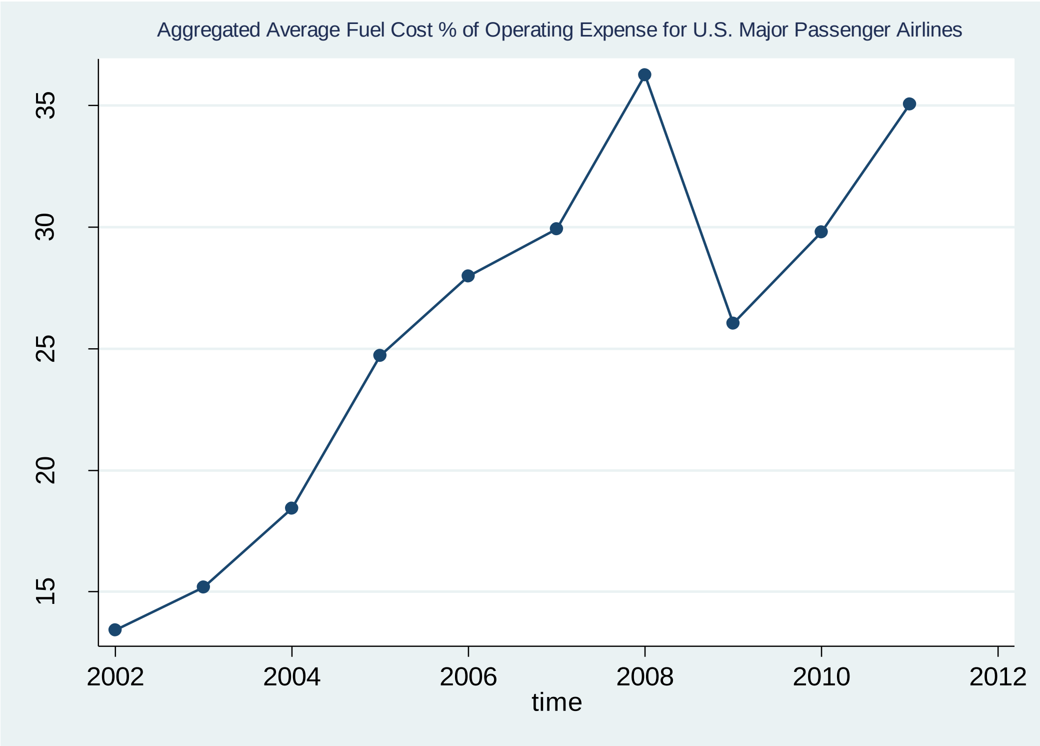

Figure 1.1 : Aggregated Average Fuel Cost % of Operating Expense for the U.S. Major Passenger Airlines.

Three approaches are generally used to deal with fuel prices by airlines. These are increasing the fuel efficiency of their operations, passing cost increase on to their customers as price increases or surcharges, and hedging fuel costs using physical or derivatives markets. Changing fuel efficiency is closely related to alteration in operating procedures or tankering policies. Substituting existing aircraft with more fuel efficient ones may take place gradually. However, it reduces profit volatility from fuel price changes in the same way permanent fuel hedging policy. On the other hand, there are limits to how much can be achieved increasing fuel efficiency, given safety requirements. Airlines can pass fuel cost increases on to their customers on the cargo side, however, surcharges are rarer on the passenger side (Morrell, 2007).

Airline managers usually declare that their aim is to stabilize fuel prices and hence overall costs, cash flows and profits by implementing hedging strategies. The implication is that the market will react to declined profits volatility, with a higher stock price. The rationale of aircraft fuel hedging is to reduce a major source of swings in profits against a sudden up-turn in fuel prices, and possibly increase the price of airline’s stock. If volatility in profits is not reduced by using hedging instruments, hedging may still play an accounting role in transfering profits from one time period to another, insure against bankruptcy, and signal the competence of management to investors. Three ways can be used against aircraft fuel price risk: forward contracts, futures contracts, options, collars and swaps (Morrell and Swan, 2006).

The behavior of jet fuel and crude oil prices have been of great interest on academic events in the last decade. For example, SIAM Minisymposium called "New Horizons in Quantitative Methods for Finance and Economics" was organised by Ahmet Duran and Gunduz Caginalp, in July, 2006 in Boston and this topic was discussed. More recently, hedging in airlines industry was one of the main topics of International Conference on Mathematical Finance and Economics held in July, 2011 in Istanbul and "Efficient Strategies in Energy Markets" panel was moderated by Stathis Tompaidis.

Most studies have focused on determinants of a firm's decision to hedge. Someof them are Smith and Stulz (1985), Froot, Scharfstein and Stein (1993) and Nance, Smith and Smithson (1993). No study has addressed the question of whether there is a direct relation between hedging and firm value until Allayannis and Weston's (2001) study.

According to the perfect market hypothesis of Modigliani and Miller (1958), the firm value is independent from hedging strategy due to the fact that shareholders can hedge on their own by holding well-diversified portfolios and firms does not face any frictions, such as financial distress costs, taxes, costly external finance, asymmetric information and so on. However, in real financial market, there are market imperfections that lead to some value effect of hedging due to relaxing the assumptions of a perfect market and introducing frictions into the Modigliani and Miller model (Khediri and Folus, 2010).

There is no consensus in the literature on this subject. Although Allayannis and Weston (2001), Carter et al. (2003, 2006, 2006b) documented that there is a hedging premium, Nyguyen and Faff (2010) and Khediri and Folus (2010) stated that a hedging discount is imposed on derivatives users rather than a hedging premium. On the other hand, Jin and Jorion (2006) demonstrated that hedging has no perceptible effect on firm value for oil and gas producers. Furthermore, Zou (2010) found that there is an inverted U-shape relation between property insurance and firm value.

We followed the methodology pioneered by Allayannis and Weston (2001) and after used by Carter et al. (2003) on entire U.S. airline industry in order to examine the relation between firm value and aircraft fuel hedging. Our main difference is to evaluate only the U.S. major passenger airlines instead of testing entire industry. This is the first attempt to examine the relation between aircraft fuel hedging and firm value for the U.S. major passenger airlines. One of the reasons why we concentrate only on major airlines is that major airlines hedge their jet fuel cost more commonly than smaller airlines. Due to the application of fresh-start reporting, we divided the entire period of 2002-2011 into four different periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011.

After identifying the probable models, we tested the groupwise heteroskedasticity, autocorrelation and cross-sectional dependence. In accordance with these tests' results, all models were estimated with balanced panel fixed effect model with Driscoll-Kraay standart errors by using STATA 11.

Our results suggest that consistent with Jin and Jorion (2006), hedging has no perceptible effect on firm value for the U.S. major passenger airlines. However, hedging with aircraft fuel exposure with derivatives shows negative and statistically significant at the 10% level during the period of 2007-2011. Moreover, airlines that prefer to use aircraft fuel hedging with derivatives have on average a 11.28% lower value premium than airlines that do not prefer to use them.

On the other hand, the estimated coefficients for the percentage of next year's fuel requirements hedged are positive and statistically significant at the 5% level for the periods of 2002-2011 and 2006-2011. However, these coefficients are at least positive but statistically insignificant for the periods of 2007-2011 and 2008-2011. For those airlines in our sample, on average, airline that hedge their fuel cost exhibits a value premium of around 9%, 7.34%, 3.99% and 4% for periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011, respectively.

Lastly, the dynamic models were estimated by adding lagged dependent variable among the regressors in order to incorporate possible effects of the previous year's firm value. All dynamic models were estimated by using the balanced panel fixed effects model with Driscoll-Kraay standart errors and time effects dummy. If the time dummies are not jointly significant, we excluded them from the models.

The remainder of the thesis is organized as follows. The next chapter presents broad literature review on this topic. In chapter 3, we give information about our sample, define both dependent variable and independent variables, construct our econometric models and finally give results of our empirical models. Lastly, final chapter sets out the concluding remarks.

2. LITERATURE REVIEW

No study has conducted in order to examine whether hedging affects firm value until the last decade. Most studies have concentrated determinants of a firm’s decision to hedge. Therefore, there are a few researches on this topic in the literature. It is the first time Allayannis and Weston (2001) examined the potential impact of the use of foreign currency derivatives on firm value. Their seminal paper has initiated further empirical researches. Many researchers have benefited greatly from their model as a benchmark. The first study that investigates the relationship between jet fuel hedging and firm value was conducted by Carter, Rogers and Simkins (2003). In this section, we have listed studies that analyze firms’ hedging behaviour, its rationales and its potential impact on firm value in chronological order, and have summarised main results of these studies.

Smith and Stulz (1985) develop a positive theory of the hedging by value-maximizing corporations in which hedging is part of the overall corporate financing policy.By examining taxes, contracting costs and the impact of hedging policy on the firm’s investment decisions as explanations of the observed wide diversity of hedging practices among large and widely-held corporations, they show that a value-maximizing firm can hedge for three reasons: (i) taxes (ii) cost of financial distress, and (iii) managerial risk aversion.

Froot, Scharfstein and Stein (1993) observe that when external finance is more costly than internally generated sources of funds, it can make sense for firms to hedge. They propose that hedging is beneficial if it can allow a firm to avoid unnecessary fluctuations in either investment spending or funds raised from outside investors. They state that to the what extent that hedging can decrease variability in cash flows, it can raise the value of the firm. In Froot et al. (1993), the underinvestment problem which would stem from variation in cash flows and costly access to external financing can be reduced by using hedging strategies. Similar to Smith and Stulz’s (1985) reasons for hedging, they also point out rationales behind corporate risk management which can be listed as (i) managerial motives, (ii) taxes, (iii) costs of financial distress and debt capacity, and (iv) capital market imperfections and inefficient investment.

Nance, Smith and Smithson (1993) provide additional evidence which complements other examinations of corporate hedging policy. They state that firms hedge so as to reduce expected tax liabilities, to lower expected transactions costs, and to control agency problems. They conclude that the value of the firm can be increased by implementing off-balance-sheet hedging via reducing expected taxes, the cost associated with financial distress, or agency costs. They express benefits of hedging as (i) reduction in expected taxes, (ii) reduction in expected transactions costs of financial distress, and (iii) reduction in agency costs.

Geczy, Minton and Schrand (1997) conducted research on Fortune 500 U.S. industrial firms for fiscal year 1990 in order to analyze the determinants of corporate use of currency derivatives from perspectives of managers, debtholders, and equityholders. They found that firms with greater growth opportunities and low accessibility to both internal and external financing which can be called tight financial constraints are most likely to use currency derivatives. In brief, they documented that firms' use of currency derivatives is positively related to growth opportunities, consistent with the Froot et al. (1993) theory of hedging. Their findings suggest thatfirms that encounter greater variation in cash flow stemming from exposure to foreign exchange-rate risk have greater potential benefits of using hedging derivatives.According to them, this results suggest that firms might use derivatives to decrease variation in cash flow that might prevent firms from investing from valuable growth opportunities.

No study has addressed the question of whether there is a direct relation between hedging and firm value until Allayannis and Weston's (2001) study. Most studies have discussed what determines a firm's decision to hedge (Allayannis and Weston, 2001). In their seminal paper, they examined the use of foreign currency derivatives in a sample of 720 large U.S. nonfinancial firms between 1990 and 1995 and its potential impact on firm value.

In Allayannis and Weston (2001), they found that a positive relation between firm value and the use of foreign currency derivatives by using Tobin's Q as an approximation for firm market value. They deduced that the hedging premium is statistically and economically significant for firms with exposure to exchange rates and is on average 4.87% of firm value in which hedging premium ranges from 3.62% and 5.34% of firm value. This evidence may be evaluated as firms that use currency derivatives have a 4.87% higher value than firms that do not use currency derivatives.

Allayannis and Weston (2001) also found evidence that firms that initiate a hedging strategy experience a raise in value above those firms that prefer to remain unhedged and that firms that give up hedging face a decline in value relative to those firms that prefer to remain hedged.

Adam (2002) conducted a study on the North American gold mining industry in order to investigate whether the use of derivatives is likely to affect derivatives users' financing policies and to reduce firms' dependence on external capital market. He found that a strong positive relation between the minimum revenue guaranteed by hedging and investment expenditures. The implication of this result is that likelihood that investments can be financed internally is increased by using hedging strategies. He also found that firms tend to finance their investment expenditures externally rather than internally. The median firm that hedges finance only 86% of investment externally.This finding suggests that when external capital is costly, firms hedge to increase the correlation between internal funds and their investments in order to reduce their dependence on external finance. According to him, firms should fully hedge in the absence of any costs. In the presence of costs associated with hedging, firms should still fully hedge as long as the marginal benefit of hedging outweighs the costs.

Guay and Kothari (2003) conducted research on 234 large non-financial corporations using derivatives in order to examine that financial derivatives are an economically important component of corporate risk management and report the magnitude of their risk exposure hedged by financial derivatives. They found that the median firm's derivatives portfolio, at most, generates $15 million in cash and $31 million in value by changing interest rates, currency exchange rates, and commodity prices simultaneously by three standard deviations.

They criticized previous researches (e.g., Allayannis and Weston, 2001) not to have sufficient large sample in order to explore to what extent the sample firms' derivatives positions are beneficial. They also claimed that the substantial raises in firm value presented in the previous studies are either caused by other risk management strategies (e.g., operetional hedges) that are correlated with derivatives use, or that the results are spurious.

Although previous studies examined whether the corporate use of derivatives is consistent with theories of hedging, none of them documented large sample evidence on the magnitude of a firm's risk exposure hedged by financial derivatives. Without such evidence, it is difficult to evaluate the significance of corporations' financial derivatives portfolio in managing risk (Guay and Kothari, 2003).

Carter, Rogers and Simkins (2003) focused their attention on the underinvestment rationale for hedging documented by Froot et al. (1993) instead of the benefits of hedging from tax convexity, expected direct bankruptcy costs, and increase in the debt tax shield.

By taking into consideration the Guay and Kothari (2003) critiques, Carter et al. (2003) investigated jet fuel hedging behaviour of firms in the U.S. airline industry during 1994-2000 to examine whether such hedging is a source of value for these companies. Similar to Allayannis and Weston (2001), they used Tobin's Q as a proxy for firm value. In the light of the criticisms raised by Guay and Kothari (2002), they focused on firms using a hedgeable commodity as an input by incorporating a commodity risk exposure approach.

They found that, in general, jet fuel hedging is positively related to airline firm value. According to them, this positive relation between hedging and value suggest that investors perceive such investment as positive net present value projects. They indicated that the average jet fuel hedging premium for airlines, which is the coefficient on the hedging variable, is in the range of 12-16%. Therefore, they deduced that the hedging premium constitutes approximately a 12-16% increase in firm value. They additionally found that the positive relation between hedging and value increases in capital investment. This finding is consistent with the Froot, Scharfstein and Stein (1993) framework that principal benefit of jet fuel hedging by airlines stem from reduction of underinvestment costs. Their results suggest that hedging allows airlines more ability to fund investment during periods of high jet fuel prices.

Sarmas (2004) conducted a study using financial data of S&P500 companies for the year 1999 and 2001 to investigate the influence of corporate hedging determinants, such as a firm's tax liabilities, the financial distress costs and contracting costs on corporate hedging policy. His aim is to depict economic prosperity before the stock market bubble burst and economic slowdown after the crash by dividing sample periods into 1999 and 2001, respectively. He found that, in general, firms hedge to raise their value by reducing their expected tax liability and alleviating their financial distress costs, and having higher leverage increase likelihood of using hedging strategies. His results show that firms that prefer to hedge outperform financially those that prefer not to hedge during economic downturn.

Loudon (2004) studied on three major financial risks facing airlines, which are the interest rate, currency and fuel price risk exposures, for Qantas and Air New Zealand. He found that returns for Quantas and Air New Zealand are not significantly exposed to interest rate or currency risk, but both are negatively exposed to fuel price risk in the short run.

Cobbs and Wolf (2004) expressed an implementation dynamic hedging program that is actively managed by using various derivative products through the price cycle is the optimal strategy for airlines. They observed from SEC fillings that hedging increases firm value, consistent with Allayannis and Weston (2001) and Carter et al. (2003).

Carter, Rogers and Simkins (2006) conducted a research to investigate jet fuel hedging behaivour of firms in the U.S. airline industry during 1992-2003 so as to analyse whether airlines' jet fuel hedging activities influence firm value by estimating the empirical relationships between Tobin's Q which is proxy for firm value and jet fuel hedging. They constructed their models resemble those used by Allayannis and Weston (2001). Consistent with their previous study (2003), they indicated that jet fuel hedging is positively related to airline firm value. They found that the hedging premium which is added firm value attributable to hedging constitutes approximately a 5%-10% increase in firm value. They demonstrated that most of the hedging premium is stemmed from the interaction of hedging with investment. This result is consistent with underinvestment rationale presented by Froot et al. (1993). They showed that the relation between the airline industry's history of investment expenditure and jet fuel cost is largely positive, and airlines face significant distress costs.

Judge (2006) conducted a research to investigate the determinants of corporate hedging for a sample of UK non-financial firms. He found that strong evidence between the hedging decision and the expected cost of financial distress due to his definition of hedging covers all hedgers and not just derivatives users. He presented that larger firms, firms with more cash, firms with a greater probability of financial distress and with more short term debt are more likely to hedge with derivatives. His evidence shows that differences both in opportunities and incentives for reducing risk and in the types of financial price exposure perform a significant role in how firms hedge their risks.

Ciner (2006) examined whether hedging or speculation is the principal rationale behind trading in energy future markets. His study shows that price reversals in all three energy futures contracts, which are the crude oil, heating oil and unleaded gasoline futures, are occurred after that days with high trading volume. His evidence suggests that hedging is relatively more important than speculation as the main rationale to trade energy futures markets.

Jin and Jorion (2006) investigated whether hedging activities affect on firm value by using hedging performance of 119 U.S. oil and gas producers from 1998 to 2001. They demonstrated that hedging has no discernible effect on firm value for oil and gas producers, contrary to Allayannis and Weston (2001) and Carter, Rogers and Simkins (2003). They also verified that the firm's stock price sensitivity to oil and gas prices are reduced by hedging activities.

Carter, Rogers and Simkin's (2006b) additional research were conducted by using 28 U.S. airlines' financial data over the period of 1992-2003 so as to investigate whether and how the jet fuel hedging activities of airlines affect their values. Similar to their previous studies and the finance literature, they used Tobin's Q ratios to measure the market value of firms. They found that airlines that implement hedging strategies have 5-10% higher Tobin's Q ratios than those that prefer not to hedge. This result implies that an average hedging airline exhibits a value premium of around 10%. They additionally illustrated that changes in jet fuel hedging are positively related to changes in the value of the firm. Their research documented that a change from a policy of no hedging to the average level of hedging is related to an increase in value of approximately 5.5%. They also found that a strong correlation between firm value and the interaction of hedging activity with the level of capital expenditures for individual airlines. They suggest that the main source of value added by hedging is its role in preserving the firm's ability to take advantage of investment opportunities that arise when fuel prices are high and airline operating cash flows and values are down. Specifically, they found that the value premium associated with hedging increases with the level of the firm's capital investment.

Mackay and Moeller (2007) conducted a research to investigate how risk management can add value when revenues and costs are nonlinearly related to prices. They applied Smith and Stulz's model to the real side of the firm by using a sample of 34 oil refiners for the period from March 1985 to June 2004. They found that hedging can add value if revenues are concave in product prices or if costs are convex in factor prices. Their results show that risk management can add value if revenues and costs are nonlinearly related to risk factors such as energy prices. They presented that the market rewards firms that hedge when hedging creates value and penalizes firms that hedge when hedging destroys value. Their finding shows that firms that hedge financial risks create value while firms that hedge operating risks or both financial and operating risks destroy value.

Hagelin et al. (2007) used a sample of Swedish firms to look at the impact on value of a specific incentive for bad hedging: managerial stock option plans. They provided evidence that when hedging is based upon incentives from managers' options, firm value decrease. They found statistically significant evidence that firms that hedge have higher valuations, which are measured by Tobin's Q, than firms that do not hedge. They deduced that hedging to decrease the risk exposure of managerial options does not necessarily benefits shareholders. Additionally, they expressed that managerial self interested hedging reduces firm value.

Belghitar, Clark and Judge (2008) conducted a research by using a sample taken from the top 500 non-financial firms in the UK ranked by market value as of year-end 1995 so as to investigate emprical evidence on the valuation and debt capacity effects of foreign currency and interest rate hedging. Their results provide evidence of a significant relationship between firm value, measured by Tobin's Q, and foreign currency and interest rate hedging. These results are much stronger than those found in previous research that have investigated US firms due to the fact that, at least in part, non-derivative methods for hedging are considered in the US studies. They show that derivative hedging creates more value than other hedging methods.

Sturm (2009) examined whether selective hedging strategies can realistically be expected to add value to carriers. His findings suggest that selectively hedging new highs in prices may not provide a source of value to the airline industry. However, selective hedging seasonal tendencies in prices may provide a source of value.

Sebehela and Madimabe (2009) stated that the operating costs of airline can be minimized by using derivative hedging strategy, rather than doing nothing, especially in volatile economic environment; thus, derivative hedging makes better the overall financial position of the airline.

Bertus, Godbey and Hilliard (2009) compared hedging performance across multiple hedging strategies and provided substantial evidence that the two-factor stochastic convenience yield model results in a more effective hedge, especially over longer horizons**.** Their findings suggest that airlines should hedge their positions in jet fuel by taking into consideration movements in the jet fuel, crude oil spread.

Bartram, Brown and Fehle (2009) investigated the use of foreign exchange, interest rate and commodity price derivatives by 7319 firms in 50 countries that together constitutes approximately 80% of the global market capitalization of non-financial companies. They showed that derivatives use is substantially connected to other important financial characteristics such as leverage, debt maturity, holdings of liquid assets, dividend policy, and operational hedges. They provided evidence that firms that operate with less liquid derivatives markets, typically in middle-income countries, are less likely to hedge.

Nguyen and Faff (2010) examined whether the use of specific financial derivative instruments is rewarded by a higher market value for a sample of Australian publicly listed companies over the period 1999 of 2000. Their result stated that a hedging discount is imposed on derivatives users rather than a hedging premium that documented previous studies. They found that the hedging discount related to the use of swaps represents a 24% reduction in firm value, while there is little evidence indicating that the use of options is detrimental to value.

Nguyen and Faff (2010b) used a sample of large Australian firms over a 2-year period in order to investigate the relationship between the use of financial derivatives and firm risk. They illustrated that this relationship is nonlinear in nature. They found that at the aggregate level, there is no evidence that the use of financial derivatives is related to a reduction in firm risk. Their findings provide evidence that in most cases, financial derivatives are used for hedging purposes.

Khediri and Folus (2010) investigated the relationship between corporate hedging and firm value for 320 firms in France. This study is the first research that examines the relation between hedging and market value of French firms. They found, from the univariate analysis, that firms that use derivatives have lower firm value which is measured by Tobin's Q than those that do not use derivatives. This empirical evidence of a hedging discount is consistent with the study of Nyguyen and Faff (2010); however, this evidence contradicts previous studies that documented a hedging premium, such as Allayannis and Weston (2001); Carter, Rogers and Simkins (2003, 2006). They attributed this discrepancy to differences in both the characteristics and the market valuation of French and US firms and/or the financial markets and investors' behavior. On the other hand, value enhancing results that are documented by US sample researches have not been reported by multivariate tests. To sum up, they found that the use of derivatives by firms does not add value.

Zou (2010) conducted a research in order to provide evidence about the value effect of alternative risk management by analyzing corporate purchase of property insurance that is commonly used pure hedge of asset-loss risks via data set from China. He found that there is an inverted U-shape relation between property insurance and firm value measured by different versions of Tobin's Q. Thus, using property insurance, up to a certain level, has a positive effect on firm value; however, over insurance has a detrimental effect on firm value. Their estimation of average hedging premium is about 1.5% which is lower than documented figures in both Allayannis and Weston (2001) and Carter, Rogers and Simkins (2003, 2006).

Parcharidis and Varsakelis (2010) examined the consequences of R&D investment on firm value measured by Tobin's Q for firms publicly traded in an emerging financial market by using data for the manufacturing and computer firms listed in the Athens Stock Exchange for the period 1996-2004. They found that the decisions of a firm to pursue R&D activities are evaluated positively by the market, and thus the

R&D capital positively affects firm value. Their findings provide evidence that the effect of the R&D investment on the market value is higher for small firms.

Bartram, Brown and Conrad (2011) examined the effect of derivative use on firm risk and value by using data set that includes 6888 non-financial firms headquartered in 47 different countries. They found strong evidence that both total and systematic risk is reduced by using financial derivatives. Their result suggest that there is a positive relation between derivative use and firm value, however, the effect of derivative use on firm value is more sensitive to endogeneity and omitted variable concerns. During the economic downturn in 2001-2002, using derivatives is related to significantly higher value, abnormal returns, and larger profits. They also documented that, on average, derivative user tend to be larger and older firms.

In Gomez-Gonzales, Rincon and Rodriguez (2012), they used quarterly financial information of 81 large Colombian nonfinancial firms for the period March 1995-December 2008 in order to examine the effects of risk management and hedging decisions on firms' market value. They found that the growth rate of Tobin's Q depends significantly on a firm's size and hedging strategies. Their evidence suggests that an increase in hedging causes to a higher growth in the firms' value.

Allayannis, Lel and Miller (2012) investigated the effect of corporate governance on the value of foreign currency derivative usage using a broad sample of firms across 39 countries with significant exchange rate exposure. They found that there is a positive and significant association between currency derivatives usage and firm value for firms with exchange rate exposure. Their evidence suggest that the magnitude of the hedging premium, on average, is 10.7% which means that on average, foreign currency derivative users are valued approximately 10.7% higher than nonusers. They also documented that firms that only have strong internal or strong external corporate governance get a significant premium for foreign currency derivatives, while they found no premium for firm with weak corporate governance.

3. DATA AND METHODOLOGY

In this section, we will show our sample description, define both dependent variable and independent variables, present their descriptive statistics and graphs, construct the econometric models, and finally present outcome of the empirical models, respectively.

3.1 Sample Description

According to the Air Transport Association of America (ATA), the U.S. airlines are classified based on the amount of their annual operating revenue. These classifications are major, national and regional. Major carriers are defined as an airline with annual operating revenue in excess of $1 billion, and national carriers are airlines with annual operating revenues between $100 million and $1 billion. Regional carriers are airlines that generate annual operating revenues less than $100 million, and whose service is often limited to a single geographic region of the country. They usually transport travelers between the major cities of their region and smaller, surrounding communities. Further classification can be made as passenger and cargo (or freighter) carriers. However, we focused on only passenger airlines due to the fact that cargo airlines have passed fuel price increases on to their customers, however, on the passenger side, surcharges are rarer.

Previous studies such as Carter et al. (2003, 2006, 2006b) used the entire U.S airline industry in their sample without taking into consideration the airlines' classification. Aircraft fuel costs are more commonly hedged by major airlines rather than smaller airlines. In Carter et al. (2003), although any aircraft fuel hedging instruments had not ever been used by some airlines in their sample, average percentage hedged next year's fuel requirements of major airlines was 23.5%. Moreover, some airlines operate as a charter airline that typically does not bear the risk of fluctuating fuel prices. That is to say, the charter's customer refunds aircraft fuel costs.

Including various airlines that have different characteristics into the same sample would lead to bias results. In order to prevent such a bias in our results, we utilized only the U.S. major passenger airlines' data in our models. This is the first attempt that considers only the U.S. major passenger airlines while evaluating their hedging performance on firm value.

Based on the U.S. DOT Form 41 Airline Operational Cost Analysis Report which published by IATA in March 2011, we determined which airline is a major airline that constitutes our sample. In this report, American Airlines, Alaska Airlines, JetBlue Airways, Continental Airlines, Delta Air Lines, Airtran Airways, Hawaiian Airlines, Northwest Airlines, United Air Lines, US Airways, and Southwest Airlines are listed as a major airline among 49 US airlines.

We calculated market share of the U.S. major passenger airlines based on available seat miles (ASM) in order to express to what extent our sample represents the U.S. airline industry. ASM represents one seat flown one mile. For instance, an airline with 100 passenger seats, flown distance of 100 miles, indicates 10.000 available seat miles. We obtained airlines' ASM from RITA: Bureau of Transportation Statistics. As shown in the table 3.1, our sample represents about 85% of the U.S. domestic airline industry for the period of 2002-2009. There was a merger agreement between Delta Air Lines and Northwest Airlines in the year of 2009 that leads to ending Northwest Airlines' existence as a separate entity. That's why we excluded Northwest Airlines from the sample. The new sample represents 78.1% of the U.S. domestic airline industry for the period of 2002-2011, as shown in the table 3.1.

Table 3.1 : Market Share of Major Passenger Airlines based on ASM (%).

Airlines	Market Share of Major Passenger Airlines based on ASM (%)					
	2002-09	2002-11	2002-11	2006-11	2007-11	2008-11
American Airlines	17.4	17.1	17.1	16.3	16	15.9
United Air Lines	14.1	13.7			12.7	12.5
Delta Air Lines	13.1	14.5				16.4
Continental Airlines	9.1	9.3	9.3	9.8	9.9	9.9
Southwest Airlines	9	9.3	9.3	10	10.2	10.3
Northwest Airlines	8.5					
US Airways	6	6.3		6.6	6.9	7.4
JetBlue Airways	2.5	2.7	2.7	3.3	3.4	3.5
Alaska Airlines	2.3	2.4	2.4	2.5	2.5	2.5
Airtran Airways	1.7	1.9	0.9	2.3	2.4	2.4
Hawaiian Airways	0.8	0.9		1	0.9	1.1
Total	84.5	78.1	41.7	51.8	64.9	81.9

Source: This table is prepared based on data that obtain Bureau of Transportation Statistics

According to the U.S. Courts, if a business is inadequate to service its debt or pay its creditors, the business or its creditors can file with a federal bankruptcy court for protection under either Chapter 7 or Chapter 11. Among our sample, some airlines filed voluntary petition for relief under Chapter 11 of the U.S. Bankruptcy Code which permits reorganization under the bankruptcy laws of the United States.

The financial statements prior to the effective date on which the debtors emerged from bankruptcy are not comparable with financial statements for the periods on or after the effective date, nor is either period comparable to periods after the effective date due to the application of fresh-start reporting. That’s why, we cannot use the entire sample data for the period 2002 to 2011.

Among ten U.S. major passenger airlines, four airlines which are US Airways, United Air Lines, Delta Air Lines and Hawaiian Airlines filed Chapter 11 filings on different dates. The effective dates were in September 2004, in June 2005, in February 2006 and in April 2007 for US Airways, Hawaiian Airlines, United Air Lines and Delta Air Lines, respectively. Accordingly, consolidated financial data of these airlines on or after the effective date are not comparable to the consolidated financial data prior to that date. Therefore, we formed new samples for different time frame in order not to sacrifice more data from entire sample. This enables us to analyze the subsample periods besides the entire sample period. In this case, the periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011 represents 41.7%, 51.8%, 64.9% and 81.9% of the U.S. domestic airline industry, respectively.

We used audited annual reports that taken from the Securities and Exchange Commission (SEC) 10-K filings in order to obtain both financial and operating data as of 31 December for the period 2002 to 2011. If there was an amendment regarding the annual report, we took into consideration the final version of the report. We searched manually over 130 annual reports and their amendments for the period 2002 to 2011 to obtain airlines' financial and operating data and hedging information that compiled from the footnotes. Moreover, the market value of common stock figures were taken from the Bloomberg database.

According to the International Financial Reports Standards (IFRS), firms must reveal whether they use derivatives and their purpose of using derivatives. In most of the 10-K filings, item 7A called "Quantitative and Qualitative Disclosures about Market Risk" provides detailed information related to market risk that the airline faces and the derivative position for each market risk, including aircraft fuel price risk. The availability of clear data on hedging activity is of principal importance in any empirical investigation of corporate hedging**.** Data obtained from audited financial statements does not have the nonresponse bias inherent in survey designs and consistency of interpretation of information contained in the annual reports can be assumed (Judge,2006).

On September 26, 2010, Southwest Airlines entered into a merger agreement providing for the company's acquisition of Airtran Holdings, Inc.. Therefore, Airtran Airways no longer files reports with the Securities and Exchange Commission (SEC) or provides annual reports to shareholders after 2011. Hovewer, Airtran Airways' existence as a separate entity was not ended. Their availabe seat miles (ASM) data is available on the RITA: Bureau of Transportation Statistics. They have still provided services to their customers on its own behalf.

If some observations are missing, a panel data can be described as unbalanced panel data. There were several missing observations in the data set. These missing observations were filed by using the most appropriate methods in order to implement balanced panel data methodology. For instance, the method used to generate Airtran Airways data for the year of 2011 will be presented in the appendix I.

In the next section, we will present the graphs of some selected variables. In order to represent the path of each variable for all firms with only one graph, we implemented the simple aggregation rule shown in the appendix J for each variable.

As shown in table 3.2, we listed the U.S. major passenger airlines that have adequate and clear data for all possible time periods. We constructed econometric models for all these periods separately. Airlines written in red indicates the latest insertion into the sample except the first one that refers to exclusion.

Table 3.2 : Lists of U.S. Major Passenger Airlines for Different Time Periods

Whole Sample [ε] **(108 firm-year)**	**2002-2011**[ǂ] **(100 firm-year)**	**2002-2011** [ξ] **(60 firm-year)**	**2006-2011** [ϕ] **(48 firm-year)**	**2007-2011** [ξ] **(45 firm-year)**	**2008-2011**[ς] **(40 firm-year)**
American Airlines	American Airlines	American Airlines	American Airlines	American Airlines	American Airlines
United Air Lines	United Air Lines*			United Air Lines	United Air Lines
Delta Air Lines	Delta Air Lines*				Delta Air Lines
Continental Airlines	Continental Airlines	Continental Airlines	Continental Airlines	Continental Airlines	Continental Airlines
Southwest Airlines	Southwest Airlines	Southwest Airlines	Southwest Airlines	Southwest Airlines	Southwest Airlines
Northwest Airlines					
US Airways	US Airways*		US Airways	US Airways	US Airways
JetBlue Airways	JetBlue Airways	JetBlue Airways	JetBlue Airways	JetBlue Airways	JetBlue Airways
Alaska Airlines	Alaska Airlines	Alaska Airlines	Alaska Airlines	Alaska Airlines	Alaska Airlines
Airtran Airways**	Airtran Airways	Airtran Airways	Airtran Airways	Airtran Airways	Airtran Airways
Hawaiian Airlines	Hawaiian Airlines*		Hawaiian Airlines	Hawaiian Airlines	Hawaiian Airlines

ε Whole sample represent about %85 of U.S. Domestic Airline Industry for the period 2002 to 2009 based on ASM.

ǂ Excluding Northwest Airlines from the sample due to ending its separate entity, this ratio decreases to approximately %78.

ξBesides Northwest Airlines, United Air Lines, Delta Air Lines, US Airways, Hawaiian Airlines are excluded from the sample owing to filing a volutary petition for reorganization under Chapter 11 of Bankruptcy Code. Therefore, these airlines represent about %42 of the Industry for the period 2002 to 2011.

ΦIncluding both US Airways and Hawaiian Airlines, new sample shows about %52 of the Industry for the sub-period between 2006 and 2011.

ξWhen United Air Lines is included to the sample for the period between 2007 and 2011, approximately %65 of the Industry is represented by the new sub-sample

ϚAll airlines except Northwest Airlines represent about %82 of the Industry for the period 2008 to 2011.

*These airlines represent %36 of U.S. Domestic Airline Industry for the period 2002 to 2011 based on ASM.

**Airtran Airways no longer files reports with the Securities and Exchange Commission (SEC) or provides annual reports to shareholders after 2011.

3.2 Variables

Carter et al. (2003) followed the methodology pioneered by Allayannis and Weston (2001) so as to examine the relation between firm value and aircraft fuel hedging. However, they excluded some of controls variables that appear in Allayannis and Weston (2001) study such as Industrial and Geographic Diversification, Credit Rating. Our approach is similar to the procedure used by Carter et al. (2003) to investigate the same relation. Our main difference is to evaluate only the U.S. major passenger airlines instead of testing the entire industry. We updated the results of previous research of Carter et al. (2003, 2006) by both following new sampling method and taking different time periods which are the periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011 due to the application of fresh-start reporting in contrast to the periods of 1994-2000 and 1992-2002 examined by Carter et al. (2003, 2006), respectively. By dividing the entire sample period into the subsample periods, we utilized all clear available data.

3.2.1 Dependent variable

Our dependent variable is firm value which is measured by Tobin's Q. This is the most commonly used proxy for firm value in empirical studies. As in Carter et al. (2003), we measured firm value using the simple approximation of Tobin's Q, developed by Chung and Pruitt (1994) whose results show that at least 96.6% of the variability of Tobin's Q is explained by the simple approximation of Tobin's Q. Tobin's Q which is called the market-to-book assets ratio is defined as the ratio of the market value of the firm to replacement cost of assets, assessed at the end of the fiscal year for each firm (Allayannis and Weston, 2001).

Table 3.3 : Descriptive Statistics of Tobin's Q for Different Periods

Period	**Obs**	**Min**	**Mean**	**Max**	**Std. Dev.**
2002 - 2011	60	0,7945	1,3921	2,4256	0,3487
2006 - 2011	48	0,7555	1,2244	1,7791	0,2353
2007 - 2011	45	0,7555	1,1836	1,5609	0,1964
2008 - 2011	40	0,7894	1,1852	1,5609	0,1836
Aggregated	10	1,0878	1,2619	1,4081	0,1335

Source: This table is prepared based on our calculation of Tobin's Q

We presented the descriptive statistics of Tobin's Q for different time horizons in the Table 3.3. As shown in the table, the average Tobin's Q is higher than 1 for each time horizon. This means that, on average, the market value of the U.S. major airlines exceeds the replacement costs of their assets. Hovewer, there is a dramatic decline of the aggregated Tobin's Q between the year of 2006 and 2007, shown in Figure 3.1. The path of the aggregated Tobin's Q can be seen in the following figure.

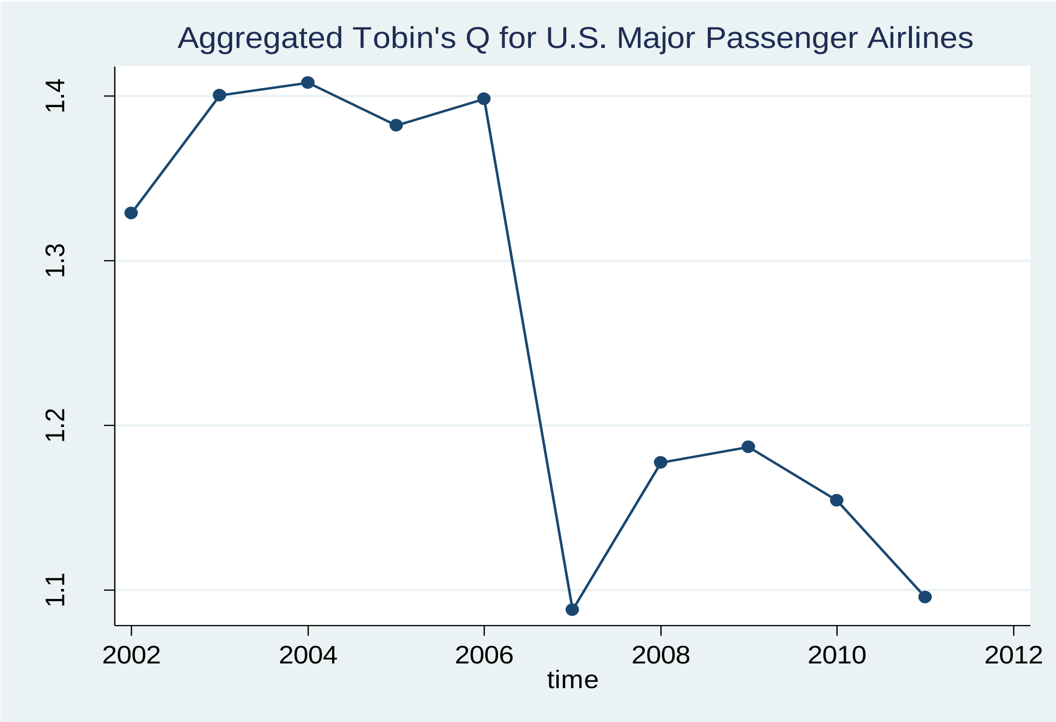

Figure 3.1 : Aggregated Tobin's Q for U.S. Major Passenger Airlines

By using the natural logarithm of the dependent varible (Tobin's Q) instead of the absolute value of them, we can interpret positive (negative) coefficients on hedging dummy variables as the hedging premium (the hedging discount) consistent with Allayannis and Weston (2001) and Carter et al. (2003, 2006).

As in previous studies, we can list several advantages of the simple approximation of Tobin's Q: first, the computational cost is to some extent low rather than other complicated calculation methods. Second, the simple approximation method uses promptly accessible balance sheet information which can be taken from the annual reports to calculate Tobin's Q. Third, as stated earlier, there is a high degree of relation between the simple approximation and more complex calculation of Tobin's Q.

According to Allayannis and Weston (2001), benefit of using Tobin's Q is to enable us relatively easier comparisons across firms than comparisons based on stock returns or accounting measures where a risk adjustment or normalization is required. They also found that their findings are independent from which measure they use to represent firm value.

In this study, Tobin's Q was calculated as in the equation 3.1:

$$Tobin's\ Q = \frac{MVCS+LVPS+BVLTD+BVCL-BVCA+BVI}{BVTA} \quad \textbf{(3.1)}$$

Where,

MVCS = Market Value of Common Stock (or Equity)

LVPS = Liquidation Value of Preferred Stock

BVLTD = Book Value of Long Term Debt

BVCL = Book Value of Current Liabilities

BVCA = Book Value of Current Assets

BVI = Book Value of Inventories

BVTA = Book Value of Total Assets

3.2.2 Independent variables

Our main aim is to investigate the relation between the U.S. major airlines' firm value and their aircraft fuel hedging practices. To achieve this task, we need to describe explanatory variables that express hedging activities of these airlines.

Hedging variables

We used two different measures of aircraft fuel hedging activity. The first one is a hedging dummy, and the second one is the percentage of next year's aircraft fuel requirements hedged. These variables are of central interest for the study.

Hedging dummy (HD)

As a proxy for aircraft fuel hedging activity, we usedthe dummy variable that is set to 1 for airlines that disclose any use of derivatives to hedge aircraft fuel exposure and otherwise 0 for nonusers. A positive (negative) value on the coefficient for this dummy suggests that hedging adds (reduces) value. By using the natural logarithm of

Tobin's Q, a positive coefficient on hedging dummy can be interpreted as the hedging premium which is found in Allayannis and Weston (2001), Carter et al. (2003, 2006). The hedging premium can be interpreted as added firm value attributable to hedging activities. On the other hand, a negative coefficient may be interpreted as the hedging discount which is proposed in Nguyen and Faff (2010) and Khediri and Folus (2010).

Percentage of next year's fuel requirements hedged

Airlines disclose the percentage of its coming year's aircraft fuel requirements that have hedged as of the end of the fiscal year for each firm. The coefficent of this variable can answer the following question;if an airline hedged 100% of its aircraft fuel requirements, what percentage of its firm value would be expected to change over the airline hedged non of its aircraft fuel requirements.

Table 3.4 : Descriptive Statistics of % of Next Year's Fuel Requirements Hedged

Period	Obs	Mean	Min	Max	Std. Dev.
2002 - 2011	60	34.78	0	95	20.97
2006 - 2011	48	29.64	0	95	18.71
2007 - 2011	45	28.49	0	70.00	16.36
2008 - 2011	40	29.11	0	62	16.07
Aggregated	10	30.90	18.77	40.77	7.28

Source: This table is prepared based on footnotes from the annual reports.

Table 3.4 presents the descriptive statistics for the stated variable. Of hedging firms, the average percentage of next year's aircratf fuel requirements hedged is in the range between 28.49% and 34.78% for the different time periods. On average, the U.S. major passenger airline have hedged about one-third of its next year's fuel requirements.

As shown in Figure 3.2, the aggregated percentage of next year aircraft fuel requirement of the U.S. major passenger airlines are followed the zigzag-shaped path. This aggregated variable reached the peak in the year of 2008. When compared the the years of 2002 and 2011, the aggregated percentage of next year aircraft fuel requirement decreased from nearly 40% to 18%.

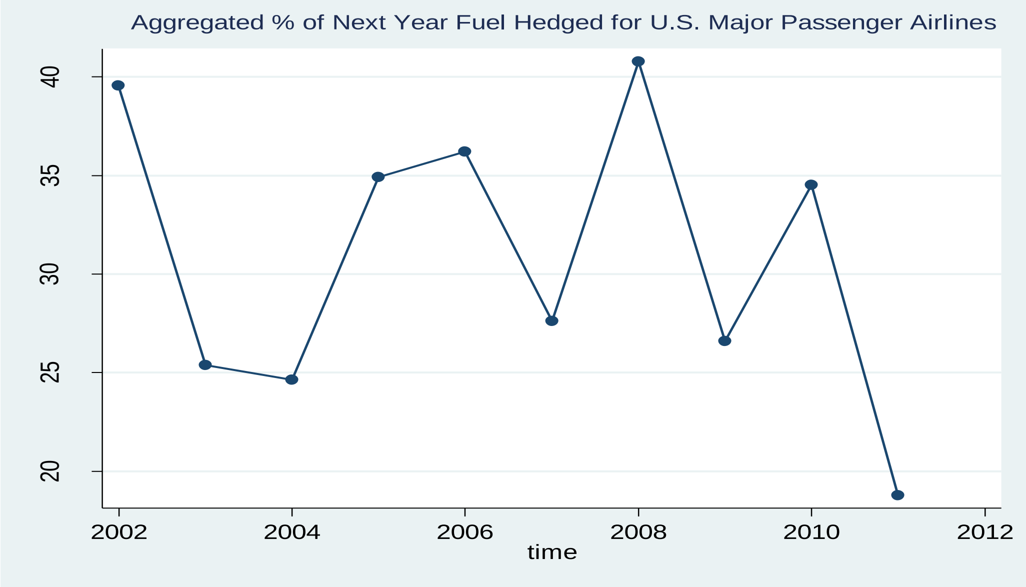

Figure 3.2 : Aggreagted % of Next Year Fuel Hedged for U.S. Major Passenger Airlines

Control variables

In addition to aircraft fuel hedging, other factors that airlines have can affect their firm value. To show whether aircraft fuel derivative hedging increases the value of the U.S. major passenger airlines, we need to exclude all possible effects that comes from other variables. We include proxy variables in order to control these other effects. The control variables were structured to be consistent with those in the empirical analysis of both Allayannis and Weston (2001) and Carter et al. (2003, 2006).

Firm size

There is ambiguous evidence whether firm size leads to higher firm value. Although Allayannis and Weston (2001) and Carter et al. (2003) found that a negative relation between firm size and firm value, Jin and Jorion (2006) and Adam (2002) documented that larger firms are more likely to use derivatives than smaller firms. However, larger firms are more probable to use hedging instruments due to the high start-up costs of hedging program (Allayannis and Weston, 2001). For instance, Jin and Jorion (2006) found that hedgers, on average, are two to three times the size of nonhedgers. Therefore, we need to take into consideration the possible effect of firm size. To do this, we included the natural logarithm of total assets in our empirical modelsas consistent with the previous research. Table 3.5 documents descriptive statistics of the U.S. major passenger airlines' total assets. As shown in the table, average amount of total assets are in the range between $9.5 billion and $14 billion.

Table 3.5 : Descriptive Statistics for Total Assets (in thousand $)

Period	Obs	Mean	Min	Max	Std. Dev.
2002 - 2011	60	10.321.919	473.450	27.650.000	8.256.511
2006 - 2011	48	9.430.209	819.953	25.850.000	7.559.168
2007 - 2011	45	10.742.453	823.399	25.385.000	7.859.773
2008 - 2011	40	13.979.191	929.134	45.014.000	12.397.125
Aggregated	10	20.207.356	15.502.137	25.135.020	3.951.939

Source: This table is presented based on information from the annual reports.

Dividend dummy (DD)

Dividendshave also ambiguous impact on firm value. If hedgers face capital constraints, their firm value measured by Tobin's Q may be high due to the fact that they are forced to invest only on the highest possible positive net present value projects. If a firm paid a dividend, it is less probable to be capital constrained and may overinvest on the negative net present value projects and may hence have a lower Tobin's Q. On the other hand, dividends can be considered as a positive signal from management. Therefore, this leads to a higher firm value or Tobin's Q (Allayannis and Weston, 2001; Carter et al. 2003; and Jin and Jorion 2006). Following previous studies, we used a dummy variable that equal to 1 if the firms paid a common dividend in the current year. Although Carter et al. (2003) found that the coefficients of dividend dummy are positive and significant in all models, Allayannis and Weston (2001) and Khediri and Folus (2010) documented that there is a negative relation between firm value and dividend dummy. Furthermore, as noted by Jin and Jorion (2006), dividend dummy has weak and inconsistent effect on firm value.

Leverage

Same as the firm's decision to hedge, firm value may also be affected by its capital structure. It was argued by Carter et al. (2003) that a higher level of debt causes a higher probability of financial distress, and then this capital structure forces the firm to hedge. In Allayannis and Weston (2001), the relation between leverage and firm value is ambiguous. According to Jin and Jorion (2006), coefficients of leverage have positive signs. On the other hand, Carter et al. (2003) and Khediri and Folus (2010) found that there is a negative relation between these variables, however, their results are all statistically insignificant. We defined leverage as the ratio of long-term debt to total assets as consistent with Carter et al. (2003).As shown in Table 3.6, the U.S. major passenger airlines have used the long-term debt in different degree to finance their assets (or investment). On average one third of their assets have been financed by the long term debt.

Table 3.6 : Descriptive Statistics for Leverage (Long Term Debt / Total Assets)

Period	Obs	Mean	Min	Max	Std. Dev.
2002 - 2011	60	0.3438	0.098	0.5422	0.117
2006 - 2011	48	0.3402	0.1164	0.5422	0.1153
2007 - 2011	45	0.339	0.1222	0.5398	0.1074
2008 - 2011	40	0.3409	0.1391	0.5398	0.1033
Aggregated	10	0.3329	0.2829	0.3687	0.0307

Source: This table is prepared based on financial information from the annual reports.

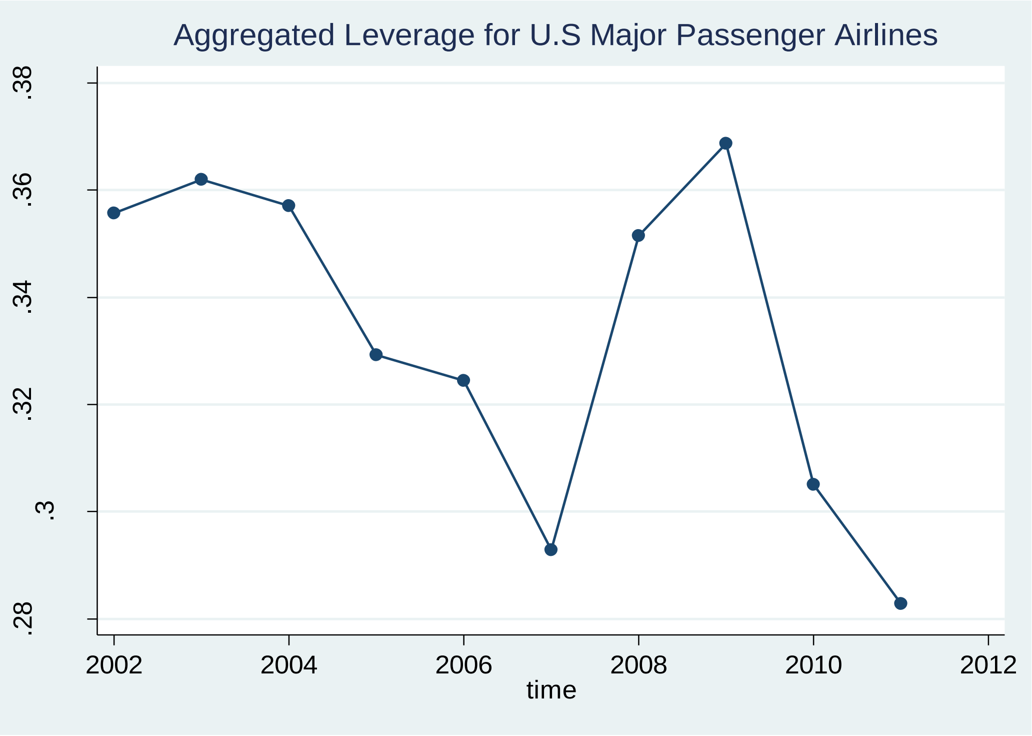

Figure 3.3 : Aggregated Leverage for U.S. Major Passenger Airlines

As shown in the Figure 3.3, the aggregated leverage of the U.S. major passenger airlines declined consistently before the global financial crisis. However, this ratio began to raise during the years of 2007 and 2008. As shown in the following figure, the aggregated profitability of the U.S. major passenger airlines declined rapidly during the global financial crisis. How could the leverage ratio increase rapidly during the global financial crisis although the profitability ratio dropped below the -10% level? In our view, the stated path of the graph can be explained by a bailout process of the U.S. financial system.

Profitability

A profitable firm is likely rewarded more by the market. Hence, we can expect that when an airline hedge its aircraft fuel exposure, its Tobin's Q will be higher. We used return on assets (ROA) that is the ratio of net income to total assets so as to incorporate possible effects of this variable into our models. Although Jin and Jorion (2006) showed that ROA has weak and inconsistent effects, Allayannis and Weston (2001), Carter et al. (2003) and Khediri and Folus (2010) found a positive relation between ROA and firm value. As shown in Table 3.7, average profitability of the U.S. major passenger airlines is fairly low for all time periods. Moreover, the net loss reached one third of their assets for some airlines.

Table 3.7: Descriptive Statistics for Return on Assets (Net Income/Total Assets)

Period	Obs	Mean	Min	Max	Std. Dev.
2002 - 2011	60	0,0011	-0,1327	0,1243	0,0442
2006 - 2011	48	0,0014	-0,3063	0,1134	0,0641
2007 - 2011	45	-0,0055	-0,3063	0,1134	0,0773
2008 - 2011	40	-0,0166	-0,3063	0,1134	0,0856
Aggregated	10	-0,0217	-0,1472	0,0251	0,052

Source: This table is prepared based on financial information from the annual reports

As shown in Figure 3.4, the aggregated profitability of the U.S. major passenger airlines declined sharply during the year of 2007. As expected, it reached the lowest figure in the year of 2008 due to the global financial crisis. However, it began to increase after the crisis.

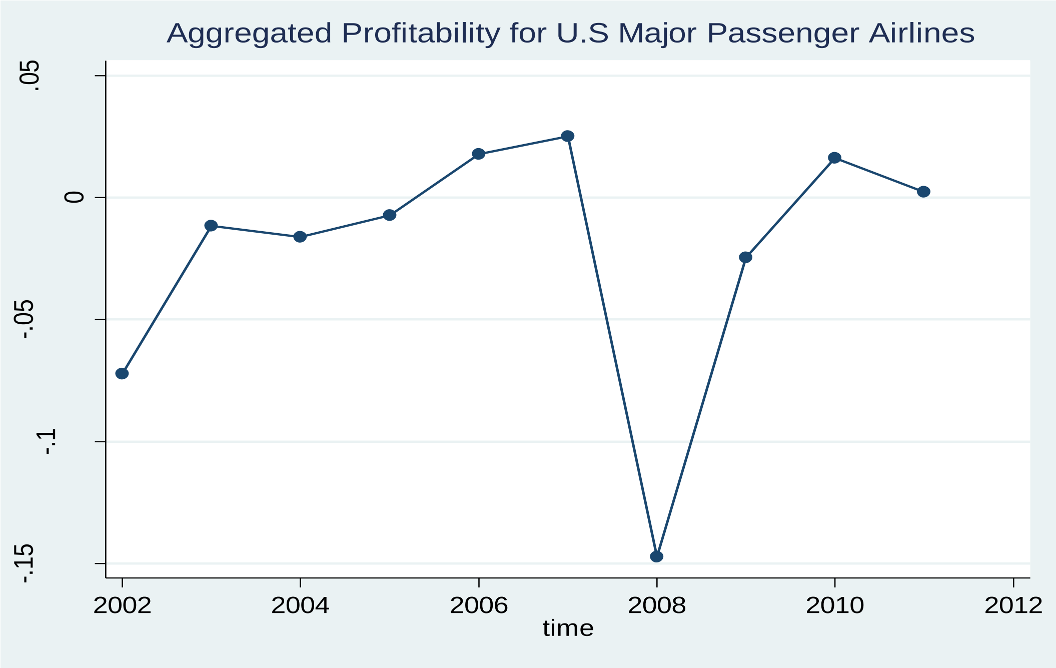

Figure 3.4 : Aggregated Return on Assets (Profitability) for U.S. Major Passenger Airlines

Investment opportunities

An airline that has more investment opportunities is probably to be valued higher by the market. Khediri and Folus (2010) documented evidence that growth opportunities have a positive impact on firm value. Even though both Allayannis and Weston (2001) and Carter et al. (2003) also found a positive relation between investment opportunities and firm value, their results were statistical insignificant. The ratio of capital expenditures to sales was used as a proxy for investment opportunities as consistent with Carter et al. (2003). The decriptive statistics of investment opportunities are given in the Table3.8.

Table 3.8 : Descriptive Statistics for Investment Opportunities (CapEx/Sales)

Period	Obs	Mean	Min	Max	Std. Dev.
2002 - 2011	60	0.1205	0.0088	0.8565	0.1588
2006 - 2011	48	0.0868	0.0088	0.4215	0.0802
2007 - 2011	45	0.069	0.0088	0.283	0.055
2008 - 2011	40	0.0599	0.0088	0.193	0.043
Aggregated	10	0.0748	0.0401	0.1062	0.0236

Source: This table is prepared based on financial information from the annual reports

The path of the aggregated investment opportunities ratio can be seen in the Figure 3.5. As shown in the figure, this ratio have consistently decreased until the year of 2010, and it began to increase after that year. However, the current level is far below the level that was in the beginning of the period. They devoted approximately 4% of their sales revenue to finance their capital expenditure in the year of 2011.

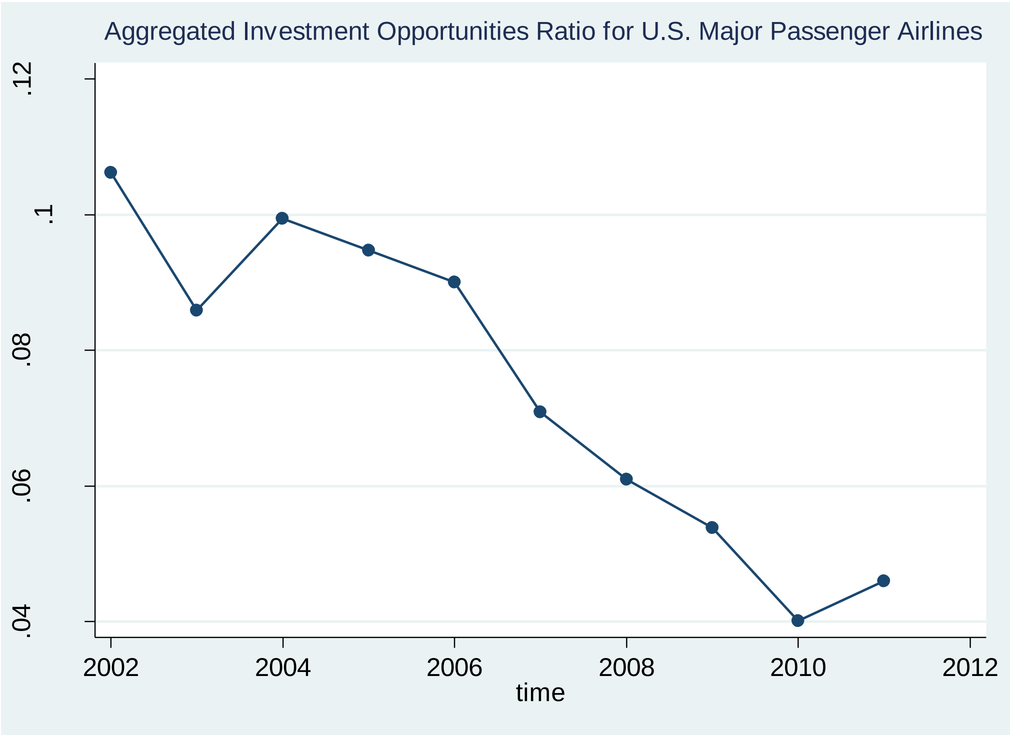

Figure 3.5 : Aggregated Investment Opportunities Ratio for U.S. Major Passenger Airlines

Time effects

In accordance with the time effects tests, we included year dummy variables in order to control for the posibility of systematic time effects on airline's firm value by following Allayannis and Weston (2001) and Carter et al. (2003).

3.3 The Models

The sample of our investigation consists of data from the U.S. major passenger airlines during the periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011. To investigate whether the aircraft fuel hedging activities of these airlines affect their values, we estimated the emprical relationships between different measures of aircraft fuel hedging activitiesand firm values which are measured by Tobin's Q. We took into consideration the natural logarithm of Tobin's Q [Ln(Tobin's Q)] instead of the absolute value. We also used two different measures of aircraft fuel hedging activities, including the percentage of next year's fuel requirements hedged [NextHedged] and the hedging dummy variable [HD] that received a value of 1 if the airline hedges its aircraft fuel exposure and 0 if it does not. Along with, we used several control variables in our analysis, firm size [Ln(TA)], measured by the natural logarithm of total assets, a dividend dummy [DD], the ratio of long term debt to total assets [Leverage], the ratio of net income to total assets [ROA], the ratio of capital expenditures to sales [CapExtoSales] and the time effects.

Panel data methodology is used due to several benefits;

1. It gives more informative data and avoids multicollinearity problems; moreover itprovides more efficients results.
2. It allows testing for individual heterogeneity.

   N.B. : Ignoring parameter heterogeneity among cross-sectional and time series units could lead to inconsistent or meaningless estimates of interested parameters.

3. It is better able to identify and measure effects that are simply not detectable in pure – cross section or pure – time series data (Baltagi, 2001; Hsiao, 1986).

The model under investigation is as follows:

$$\boldsymbol{y_{it} = \alpha + \beta' X_{it} + u_{it}} \qquad \textbf{(3.2)}$$

where $\boldsymbol{y}_{it}$ is the $\boldsymbol{it^{th}}$observation of dependent variable with i=1,…,N (airlines) and t=1,…,T (time), α is the constant term and$\boldsymbol{\beta}$is a K X 1 vector (K is the number of explanatory variables), $\boldsymbol{X_{it}}$is the $\boldsymbol{it^{th}}$observation on K explanatory variables.

$$\boldsymbol{u_{it} = \mu_i + \vartheta_{it}} \textbf{(3.3)}$$

The term μ_i is the unobserved individual specific effect or individual heterogeneity for the airline i. The $\vartheta_{it}$is the remainder stochastic disturbance term. If this is valid, the model is called as the one-way error component regression model.

$$\boldsymbol{u_{it} = \mu_i + \lambda_t + \vartheta_{it}} \qquad \textbf{(3.4)}$$

In this case, the $\lambda_t$isthe unobserved time effect. It is individual invariant and accounts for time-specific effect that is not included in the regression. Others are defined above in the (3.3) equation. If this case is valid, the model is called the two-way error component regression model.

We perfomed the time effect tests for each time horizon to determine which model could be used. Its null hypothesis is that the time dummies are not jointly significant. In accordance with results of the time effect test, we run our regressions with time effect or without time effect. That is to say, we determined whether the one-way error component regression model is valid by testing time effect. The results of the time effects tests were given in the appendix C.

In the one-way fixed effects models, the μ_i are assumed to be fixed parameters to be estimated and the remainder disturbance stochastic with ϑ_{it} independent and identically distributed IID (0, σ_ϑ^2). The X_{it} are assumed to be independent of the $\vartheta_{it}$for all i and t. On the other hand, in the one-way random effects models, μ_i ~ IID (0, σ_μ^2), ϑ_{it} ~ IID (0, σ_ϑ^2) and the μ_i are independent of the ϑ_{it}. In addition, the X_{it} are independent of the μ_i and ϑ_{it} for all i and t (Baltagi, 2001).

In the two-way fixed effects models, theμ_i and λ_t are assumed to be fixed parameters to be estimated and remainder disturbances are stochastic with ϑ_{it} ~ IID (0, σ_ϑ^2). The X_{it} are assumed independent of the ϑ_{it} for all i and t. On the contrary, if μ_i ~ IID (0, σ_μ^2), λ_t ~ IID (0, σ_ϑ^2) and ϑ_{it} ~ IID (0, σ_ϑ^2) independent of each other, the two-way random effects model is valid. In addition, X_{it} is independent ofμ_i, ϑ_{it} and λ_t for all i and t (Baltagi, 2001).

We also tested for the fixed effect model versus the pooled OLS and the random effects models. The fixed effect model versus the pooled OLS is tested via an F-test. Its null hypothesis is that the fixed effect model is preferred to the pooled OLS. To decide between the fixed or random effects we run a Hausman test for each model.The null hypothesis is that the differences in coefficients are not systematic. If the null hypothesis was rejected, we used the fixed effect model; otherwise, the random effects model was valid. According to the Hausman test, all models should be estimated by using the fixed effects methodology out of the second model. Its Hausman test statistic $\chi^2$was negative. Schreiber (2008) showed that the Hausman chi-square test statistic may be negative not only in small samples but even asymtotically as well. On the other hand, the fixed effect model was preferred to the pooled OLS with respect to the F-tests for all models. The results of F-tests and Hausman tests were given in the appendix B and A, respectively.

The fixed effects model is a suitable specification if we are concentrate a specific set of N firms and our inference limited to the behavior of these set of firm (Baltagi, 2001). In line with Baltagi (2001), the second model was also estimated by using the fixed effect methodology.

After identifying the probable models, we tested the groupwise heteroskedasticity, autocorrelation and cross-sectional dependence. The results of these tests were given in the appendix D, E and F, respectively. In accordance with these tests' results, all models were estimated with fixed effect methodology with Driscoll-Kraay standart errors by using STATA 11.

3.3.1 Estimations of Panel Data Models

As shown in Table 3.9, the performance of our models is relatively good as indicated with-in R-squared. Table 3.9 presents the main results obtained from the estimation of the effect of aircraft fuel hedging activities on airline firm value.

We found weak and statistically insignificant relation between hedging dummy and firm value for all periods except the period of 2007-2011. Consistent with Jin and Jorion (2006), hedging has no perceptible effect on firm value for the U.S. major passenger airlines. However, hedging aircraft fuel exposure with derivatives shows negative and statistically significant at the 10% level during the period of 2007-2011 consistent with the findings of Nguyen and Faff (2010) and Khediri and Folus (2010) which proposed hedging discount rather than hedging premium. This result shows us that the U.S. major passenger airlines that prefer to use aircraft fuel hedging with derivatives have on average a 11.28% lower value than those that do not prefer to use them over the period of 2007-2011.

On the other hand, the estimated coefficients for the percentage of next year's fuel requirements hedged are positive and statistically significant at the 5% level for the periods of 2002-2011 and 2006-2011. However, these coefficients are at least positive but statistically insignificant for the periods of 2007-2011 and 2008-20011.

In the case of Model 1, the coefficent of 0.2598 can be interpreted by declaring that an airline that hedges 100% of its aircraft fuel requirements would be anticipated to have value premium of almost 26% over an airline hedges non of its aircraft fuel requirements. The average percentage of next year's fuel requirements hedged was 34.78% during the period 2002-2011. Hence, for those airlines in our sample, on average,an airline exhibits a value premium of around 9% [0.2598*0.3478] by implementing hedging strategies. The value premium is 7.34%, 3.99% and 4% for periods of 2006-2011, 2007-2011 and 2008-2011, respectively. As a comparison with Carter et al. (2003, 2006), they deduced that the hedging premium constitutes about a 12-16% and 5-10% increase in firm value, respectively.

Although the hedging discount was valid with hedging dummy for the period of 2007-2011, the hedging premium results was documented with the next year's aircraft fuel requirements variable for the same period. At first glance, the results of two different hedging variables seem to contradict. However, this is not the case. If they had not hedged their fuel expense, their firm value would have been decreased more than the actual situation. For instance, the percentage of the hedging discount reported was approximately -11% for the period of 2007-2011. Had they not used any hedging instruments, this percentage would have been lower than -11%.

Most of the coefficients for the control variables are strong and statistically significant. Only one control variable, ROA, has a weak and statistically insignificant but positive relation documented for all models.

Consistent with Allayannis and Weston (2001) and Carter et al. (2003), the estimates for firm size are always negative and highly significant except the second model. In the U.S. major passenger airlines, becoming larger size does not provide advantages, with respect to firm value.

In contrast to Carter et al. (2003), the estimated parameters of the dividend dummy are negative and statistically significant out of the second model. This results are consistent with Allayannis and Weston (2001) and Khediri and Folus (2010). Our result suggest that airlines in our sample does not use dividends to signal their management competence and financial austerity.

The parameter estimates for the leverage variable are positive and highly statistically significant in all models as opposed to Allayannis and Weston (2001) and Carter et al. (2003). The coefficients of the ratio of capital expenditures to sales are statistically significant for all models out of the model8, and their signs are negative for the model3, the model4 and the model5.

Table 3. 9 : Panel Data Estimations of the Relation Between Firm Value and Aircraft Fuel Hedging Behavior for U.S. Major Passenger Airlines

	2002-2011		2006-2011		2007-2011		2008-2011	
Ln(Tobin's Q)	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Model8
LnTA	-0.1378*	-0.1486	-0.2879**	-0.3705***	-0.2325**	-0.4071***	-0.3909**	-0.4606***
DD	-0.1781***	-0.1005	-0.2276***	-0.1818***	-0.1644***	-0.2085***	-0.1627***	-0.1144**
Leverage	0.5569**	0.7896**	0.9943***	1.2776***	1.0416***	1.3557***	0.5068**	0.3902***
ROA	0.5142	0.4917	0.1396	0.1644	-0.1273	0.1334	0.1569	0.2166
CapExtoSales	0.5845***	0.4523**	-0.1943**	-0.2807*	-0.2340**	0.1901*	0.3427*	0.5652
HD	-0.0363		-0.0051		-0.1128*		0.001	
NextHedged		0.2598** (9.03%)		0.2477** (7.34%)		0.1402 (3.99%)		0.1375 (4.00%)
2007			-0.1483***	-0.1196***				
2008			-0.0738**	-0.0569**		0.0603**		
2009			-0.1216***	-0.1044***		0.0182		
2010			-0.0842**	-0.0513**		0.1085***		
2011			-0.053	0.0038		0.1373***		
Cons	3.2297*	3.2703	6.4762**	8.1401***	5.2285**	8.8523***	8.9362**	10.5170***
F	138.96	149.83	26.01	1702.83	1248.40	53169.25	5.08	4.47
Prob> F	0.000	0.000	0.0001	0.000	0.000	0.000	0.0153	0.0225
With-in R-squared	0.5488	0.5969	0.6002	0.6560	0.5062	0.6437	0.4344	0.4565

All models were estimated by using Fixed Effect Model by using Driscoll-KraayStandart Errors. ***, **, * indicates a significance at the 1, 5 and 10% levels respectively. Actual hedging premium (or discount) are reported in the parentheses.

3.3.2. Estimations of the Dynamic Panel Data Models

As stated in Baltagi (2005), many economic relationships are in dynamic nature and panel data is to allow the researcher to better understand the dynamics of adjustments. The dynamic relationships can be characterized by adding lagged dependent variable among the regressors. It is as follows:

$$\boldsymbol{y_{it} = \delta y_{i,t-1} + X_{it}\beta + u_{it}} \qquad \textbf{(3.5)}$$

Where δ is a scalar, X_{it} is 1 X K and β is K X 1. Further explanation was given in the section 3.3.

The rationale of using lagged dependent variable among the regressors is to incorporate possible effects of the previous year's firm value. A firm that have high firm value in the previous year is expected to have also high firm value at the following year. All models were estimated by using the balancedfixed effecst methodology with Driscoll-Kraay standart errors and time effects dummy. If the time dummies are not jointly significant, we excluded them from the models.

In Table 3.10, we documented negative but weak and statistically insignificant relation between hedging dummy and firm value over all periods out of the period of 2008-2011. These results resemble to the outcome of the previous models and are consistent with Jin and Jorion (2006).On the contrary, there is a positive and statistically significant at the 1% level relationship between hedging dummy and firm value for the period of 2008-2011 consistent with the Allayannis and Weston (2001) and Carter et al. (2003, 2006). According to this results, those airlines in our sample that prefer to use aircraft fuel hedging with derivatives have on average a 7% higher value than those that do not prefer to use then over the period of 2008-2011.

On the other hand, the estimated coefficients for the percentage of next year's fuel requirements hedged are positive and statistically significant at the 5% level for the periods of 2002-2011 and 2006-2011. However, these coefficients are at least positive but statistically insignificant for the periods of 2007-2011 and 2008-20011.

As shown in the Model 9, the coefficent of 0.2676 can be interpreted by declaring that an airline that hedges 100% of its aircraft fuel requirements would be anticipated to have value premium of almost 26% over an airline hedges non of its aircraft fuel requirements. The average percentage of next year's fuel requirements hedged was

34.78% during the period 2002-2011. Hence, for those airlines in our sample, on average, an airline exhibits a value premium of around 9.30% [0.2676*0.3478] by implemeting hedging strategies. The value premium is 6.13%, 2.94% and 6.72% for periods of 2006-2011, 2007-2011 and 2008-2011, respectively.

Consistent with Allayannis and Weston (2001) and Carter et al. (2003), the coefficients of the firm size are always negative and highly significant for all models. In contrast to Carter et al. (2003), the estimated parameter of the dividend dummy are negative and fairly significant for all models. This results are consistent with Allayannis and Weston (2001) and Khediri and Folus (2010). The parameter estimates for the leverage variable are positive and statistically significant in all models as opposed to Allayannis and Weston (2001) and Carter et al. (2003). The coefficients of the return on assets are positive for all models, moreover, they are statistically significant at the 5% level for the model14 and the model15.

Table 3. 10 : Dynamic Panel Data Estimations of the Relation Between Firm Value and Aircraft Fuel Hedging Behavior for U.S. Major Passenger Airlines

	2002-2011		2006-2011		2007-2011		2008-2011	
	Model9	Model10	Model11	Model12	Model13	Model14	Model15	Model16
LnTobin'sQ								
LagLnTobinQ	0,1426	0,143	-0.2494***	-0.1790***	-0.2424***	-0.2146***	-0,0787	-0,1273
LnTA	-0.1475**	-0.1569**	-0.2554**	-0.3840***	-0.4826***	-0.5091***	-0.5146***	-0.7058***
DD	-0.1660***	-0,0865	-0.2158***	-0.1930***	-0.2656***	-0.2391***	-0.2547***	-0.1931***
Leverage	0.4770**	0.7042**	1.2038***	1.3276***	1.3577***	1.4214***	1.1781***	0.9491***
ROA	0,3643	0,307	0,2038	0,2347	0,2476	0.2669**	0.1055**	0,052
CapExtoSales	0.5190**	0.3889**	-0.3822***	-0.3254*	0,0675	0,1429	0.2399**	0.5995**
HD	-0,0307		-0,0322		-0,0175		0.0699***	
NextHedged		0.2676** (9.30%)		0.2068** (6.13%)		0.1031 (2.94%)		0.231 (6.72%)
2007			-0.1243***	-0.0916***				
2008			-0.1078***	-0,0611	0.0625***	0.0651***		
2009			-0.1323***	-0.0920**	0.0424***	0.0398***	-0.0090***	0,0137
2010			-0.1104**	-0,0477	0.1209***	0.1269***	0.0865***	0.1034***
2011			-0,0821	0,0046	0.1504***	0.1625***	0.1021***	.1346***
Cons	3.4315**	3,4465	5.7662**	8.4595***	10.65245***	11.1677***	11.4439***	15.8535***
F	515,17	961,4	104,82	253,89	189,33	219,83	145,01	400,76
Prob> F	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
With-in R-squared	0,5687	0,6197	0,6527	0,6813	0,6823	0,6905	0,5986	0,6423

All models were estimated by using Fixed Effect Model by using Driscoll-KraayStandart Errors. ***, **, * indicates a significance at the 1, 5 and 10% levels repectively. Actual hedging premium (or discount) are reported in the parentheses.

4. CONCLUSION

This study examined the aircraft fuel hedging behavior of the U.S. major passenger airlines during the periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011. One of the goals of this study is to analyze whether airlines' aircraft fuel hedging strategies affect firms' values for such time horizons. We evaluated the relation between firms' values and the percentage of next year's fuel requirements hedged. Our study is the first examination of the relation between aircraft hedging and firm value of the U.S. major passenger airlines. We updated the results of previous research of Carter et al. (2003, 2006) by both following new sampling method and taking different time periods which are the periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011 due to the application of fresh-start reporting in contrast to the periods of 1994-2000 and 1992-2002 examined by Carter et al. (2003, 2006), respectively.

Consistent with Jin and Jorion (2006), hedging has no perceptible effect on firm value for the U.S. major passenger airlines over all time periods out of the period of 2007-2011. However, hedging with aircraft fuel exposure with derivatives shows negative and statistically significant at the 10% level during the period of 2007-2011. Airlines that prefer to use aircraft fuel hedging with derivatives have on average a 11.28% lower value than airlines that do not prefer to use them. This result is consistent with Nyguyen and Faff (2010) that proposed the hedging discount. The estimated coefficients for the percentage of next year's fuel requirements hedged are positive and statistically significant at the 5% level for the periods of 2002-2011 and 2006-2011. However, these coefficients are at least positive and statistically insignificant for the periods of 2007-2011 and 2008-20011. The value premium is 9%, 7.34%, 3.99% and 4% for periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011, respectively.

At first glance, the results of two different hedging variables seem to contradict. However, if they had not hedged their fuel expense, their firm value would have been decreased more than the actual situation. For instance, the percentage of the hedging discount reported was approximately -11% for the period of 2007-2011. Had they not used any hedging instruments, this percentage would have been lower than -11%.

On the other hand, the dynamic models were estimated by adding lagged dependent variable among the regressors in order to incorporate possible effects of the previous year's firm value. All dynamic models were estimated by using the balanced fixed effecst model with Driscoll-Kraay standart errors and time effects dummy. If the time dummies are not jointly significant, we excluded them from the models.

Similar to previous model, we documented negative but weak and statistically insignificant relation between hedging dummy and firm value over all periods out of the period of 2008-2011. These results resemble to the outcome of the previous models and are consistent with Jin and Jorion (2006). On the contrary, there is a positive and statistically significant at the 1% level relationship between hedging dummy and firm value for the period of 2008-2011 consistent with the Allayannis and Weston (2001) and Carter et al. (2003, 2006). According to this results, those airlines in our sample that prefer to use aircraft fuel hedging with derivatives have on average a 7% higher value than those that do not prefer to use then over the period of 2008-2011. The estimated coefficients for the percentage of next year's fuel requirements hedged are positive and statistically significant at the 5% level for the periods of 2002-2011 and 2006-2011. However, these coefficients are at least positive but statistically insignificant for the periods of 2007-2011 and 2008-20011. The value premium is 9.30%, 6.13%, 2.94% and 6.72% for periods of 2002-2011, 2006-2011, 2007-2011 and 2008-2011, respectively.

Further analysis should be undertaken to comprehend the precise relationships between firm value and hedging activities for both different industries and countries. Cross-country analysis should be certainly made in order to investigate whether the use of derivatives affects firm value.

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APPENDICES

APPENDIX A : Results of Hausman Tests

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.1378852	-.0583239	-.0795613	.0505652
DD	-.178193	.3298428	-.5080358	.0999822
Leverage	.5569884	.5517894	.005199	.1920017
ROA	.5142995	.3857364	.1285631	.
CapExtoSales	.5845842	.7074191	-.1228349	.1025371
HD	-.0363061	.0152048	-.0515109	.

```
                 b = consistent under Ho and Ha; obtained from xtreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       38.07
            Prob>chi2 =      0.0000
            (V_b-V_B is not positive definite)
```

Table A.1 : Hausman Test for the period of 2002-2011 with HD

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.1486528	-.0370351	-.1116177	.0463028
DD	-.1005529	.3054888	-.4060417	.0998387
Leverage	.7896355	.942499	-.1528635	.1177743
ROA	.4917811	.4011565	.0906246	.
CapExtoSales	.4523648	.5929765	-.1406117	.1006053
NextHedged	.2598607	.3394176	-.0795569	.

```
                 b = consistent under Ho and Ha; obtained from xtreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =  -430.73    chi2<0 ==> model fitted on these
                                    data fails to meet the asymptotic
                                    assumptions of the Hausman test;
                                    see suest for a generalized test
```

Table A.2 : Hausman Test for the period of 2002-2011 with NextHedged

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.3365023	-.0000586	-.3364437	.1181315
DD	-.1905026	.0420671	-.2325696	.0362995
Leverage	.8218629	.9406322	-.1187693	.1742212
ROA	.006008	.0111881	-.0051801	.
CapExtoSales	-.0311059	.2778227	-.3089286	.
HD	-.0509863	-.0007637	-.0502226	.

```
                 b = consistent under Ho and Ha; obtained from xtreg
    B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       20.49
            Prob>chi2 =      0.0023
            (V_b-V_B is not positive definite)
```

Table A.3 : Hausman Test for the period of 2006-2011 with HD

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.3371918	.007434	-.3446258	.1131421
DD	-.1089913	.155088	-.2640793	.0597987
Leverage	1.136904	1.253094	-.1161896	.1737438
ROA	.0671429	.0057307	.0614122	.
CapExtoSales	-.1470325	.1606718	-.3077042	.
NextHedged	.2410133	.3519099	-.1108966	.

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       25.77
            Prob>chi2 =      0.0002
            (V_b-V_B is not positive definite)
```

Table A.4 : Hausman Test for the period of 2006-2011 with NextHedged

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.2325992	.0121892	-.2447884	.1255761
DD	-.1644979	.1590496	-.3235475	.0461349
Leverage	1.041617	.8582228	.1833944	.2153158
ROA	-.1273805	-.1082046	-.0191759	.
CapExtoSales	-.2340681	.2531796	-.4872477	.
HD	-.1128568	-.0267916	-.0860652	.

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       21.03
            Prob>chi2 =      0.0018
            (V_b-V_B is not positive definite)
```

Table A.5 : Hausman Test for the period of 2007-2011 with HD

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.2111763	.0155931	-.2267693	.1306831
DD	-.1503852	.2153032	-.3656883	.0764029
Leverage	1.210239	1.100943	.1092963	.2278908
ROA	-.0123895	-.0294136	.0170241	.
CapExtoSales	-.2781368	.3055485	-.5836853	.
NextHedged	.0406498	.3030171	-.2623673	.

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       20.36
            Prob>chi2 =      0.0024
            (V_b-V_B is not positive definite)
```

Table A.6 : Hausman Test for the period of 2007-2011 with NextHedged

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.3909016	.010214	-.4011156	.1628936
DD	-.1627207	.0956698	-.2583905	.038017
Leverage	.5068097	.8193921	-.3125824	.2875575
ROA	.1569654	.1972468	-.0402814	.
CapExtoSales	.3427843	.1660206	.1767638	.1818295
HD	.0016818	.0833007	-.081619	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 224.71
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table A.7 : Hausman Test for the period of 2008-2011 with HD

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnTA	-.4606873	.0205663	-.4812537	.1701776
DD	-.1144675	.2365646	-.351032	.0713363
Leverage	.3902168	.9887023	-.5984854	.3182678
ROA	.2166267	.2649663	-.0483397	.
CapExtoSales	.5652837	.5291681	.0361156	.3002149
NextHedged	.1375062	.3218719	-.1843657	.0285729

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 30.37
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Table A.8 : Hausman Test for the period of 2008-2011 with NextHedged

APPENDIX B : Results of F Tests

Fixed-effects (within) regression Number of obs = 60
Group variable: id Number of groups = 6

R-sq: within = 0.5488 Obs per group: min = 10
between = 0.0681 avg = 10.0
overall = 0.1511 max = 10

F(6,48) = 9.73
corr(u_i, Xb) = -0.6608 Prob > F = 0.0000

LnTobinQ	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.1378852	.055585	-2.48	0.017	-.2496463	-.026124
DD	-.178193	.1206476	-1.48	0.146	-.4207712	.0643852
Leverage	.5569884	.3156143	1.76	0.084	-.0775966	1.191573
ROA	.5142995	.4499528	1.14	0.259	-.3903912	1.41899
CapExtoSales	.5845842	.1681605	3.48	0.001	.2464748	.9226935
HD	-.0363061	.0845409	-0.43	0.670	-.2062871	.1336748
_cons	3.229724	1.266613	2.55	0.014	.6830282	5.776419
sigma_u	.27230239					
sigma_e	.11232601					
rho	.85458391	(fraction of variance due to u_i)				

F test that all u_i=0: F(5, 48) = 9.01 Prob > F = 0.0000

Table B.1 : F test for the period of 2002-2011 with HD

```
Fixed-effects (within) regression               Number of obs      =        60
Group variable: id                              Number of groups   =         6

R-sq:  within  = 0.5969                         Obs per group: min =        10
       between = 0.1502                                        avg =      10.0
       overall = 0.2415                                        max =        10

                                                F(6,48)            =     11.85
corr(u_i, Xb)  = -0.6218                        Prob > F           =    0.0000

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.1486528   .0517347    -2.87   0.006    -.2526725   -.0446331
          DD |  -.1005529   .1184369    -0.85   0.400    -.3386863    .1375804
    Leverage |   .7896355   .2953573     2.67   0.010     .1957798    1.383491
         ROA |   .4917811   .4241099     1.16   0.252    -.360949     1.344511
CapExtoSales |   .4523648    .165669     2.73   0.009     .1192649    .7854646
  NextHedged |   .2598607   .1067266     2.43   0.019     .0452725    .4744488
       _cons |   3.270397   1.192022     2.74   0.009     .8736767    5.667118
-------------+----------------------------------------------------------------
     sigma_u |  .24672156
     sigma_e |  .10617567
         rho |  .84374103   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5, 48) =     8.87              Prob > F = 0.0000
```

Table B.2 : F Test for the period of 2002-2011 with NexHedged

```
Fixed-effects (within) regression               Number of obs      =        48
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.4494                         Obs per group: min =         6
       between = 0.0870                                        avg =       6.0
       overall = 0.0230                                        max =         6

                                                F(6,34)            =      4.63
corr(u_i, Xb)  = -0.9245                        Prob > F           =    0.0016

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.3365023   .1298656    -2.59   0.014     -.600421   -.0725836
          DD |  -.1905026   .1126632    -1.69   0.100    -.4194617    .0384565
    Leverage |   .8218629   .3896734     2.11   0.042     .0299513    1.613775
         ROA |    .006008   .2983664     0.02   0.984    -.6003456    .6123616
CapExtoSales |  -.0311059   .2759269    -0.11   0.911    -.5918568     .529645
          HD |  -.0509863   .0992636    -0.51   0.611    -.2527143    .1507417
       _cons |   7.573983   3.014598     2.51   0.017     1.447582    13.70038
-------------+----------------------------------------------------------------
     sigma_u |  .48317161
     sigma_e |  .10254899
         rho |  .95689532   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(7, 34) =     9.12              Prob > F = 0.0000
```

Table B.3 : F Test for the period of 2006-2011 with HD

```
Fixed-effects (within) regression               Number of obs      =        48
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.5090                         Obs per group: min =         6
       between = 0.0432                                        avg =       6.0
       overall = 0.0050                                        max =         6

                                                F(6,34)            =      5.87
corr(u_i, Xb)  = -0.9135                        Prob > F           =    0.0003

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.3371918   .1207618    -2.79   0.009    -.5826092   -.0917744
          DD |  -.1089913   .1132752    -0.96   0.343    -.3391942    .1212115
    Leverage |   1.136904   .3613654     3.15   0.003     .4025213    1.871287
         ROA |   .0671429   .2616396     0.26   0.799    -.4645727    .5988586
CapExtoSales |  -.1470325   .2661445    -0.55   0.584    -.6879033    .3938383
  NextHedged |   .2410133   .1146782     2.10   0.043     .0079592    .4740674
       _cons |   7.360135   2.775415     2.65   0.012     1.719812    13.00046
-------------+----------------------------------------------------------------
     sigma_u |  .46402601
     sigma_e |  .09684742
         rho |  .95825794   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(7, 34) =     6.38              Prob > F = 0.0001
```

Table B.3 : F Test for the period of 2006-2011 with NextHedged

```
Fixed-effects (within) regression               Number of obs      =        45
Group variable: id                              Number of groups   =         9

R-sq:  within  = 0.5062                         Obs per group: min =         5
       between = 0.0563                                        avg =       5.0
       overall = 0.0061                                        max =         5

                                                F(6,30)            =      5.13
corr(u_i, Xb)  = -0.8863                        Prob > F           =    0.0010

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.2325992   .1303531    -1.78   0.084    -.4988158    .0336174
          DD |  -.1644979   .0997472    -1.65   0.110    -.3682088     .039213
    Leverage |   1.041617   .3792357     2.75   0.010     .2671146     1.81612
         ROA |  -.1273805   .2279477    -0.56   0.580    -.5929119    .3381509
CapExtoSales |  -.2340681   .3694883    -0.63   0.531    -.9886639    .5205277
          HD |  -.1128568   .0902549    -1.25   0.221     -.297182    .0714684
       _cons |   5.228517   3.041377     1.72   0.096    -.9828035    11.43984
-------------+----------------------------------------------------------------
     sigma_u |  .36046843
     sigma_e |  .08850743
         rho |  .94314071   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(8, 30) =     9.22               Prob > F = 0.0000
```

Table B.4 : F Test for the period of 2007-2011 with HD

```
Fixed-effects (within) regression               Number of obs      =        45
Group variable: id                              Number of groups   =         9

R-sq:  within  = 0.4821                         Obs per group: min =         5
       between = 0.0397                                        avg =       5.0
       overall = 0.0022                                        max =         5

                                                F(6,30)            =      4.65
corr(u_i, Xb)  = -0.8726                        Prob > F           =    0.0019

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.2111763   .1343281    -1.57   0.126    -.4855109    .0631584
          DD |  -.1503852   .1129812    -1.33   0.193    -.3811235    .0803532
    Leverage |   1.210239   .3701377     3.27   0.003     .4543171    1.966161
         ROA |  -.0123895   .2181449    -0.06   0.955    -.4579009    .4331219
CapExtoSales |  -.2781368   .3791601    -0.73   0.469    -1.052485    .4962115
  NextHedged |   .0406498   .1325326     0.31   0.761    -.2300178    .3113174
       _cons |   4.567195   3.094703     1.48   0.150    -1.753032    10.88742
-------------+----------------------------------------------------------------
     sigma_u |  .34078069
     sigma_e |  .09064257
         rho |  .93392653   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(8, 30) =     5.76               Prob > F = 0.0002
```

Table B. 5 : F Test for the period of 2007-2011 with NextHedged

```
Fixed-effects (within) regression               Number of obs      =        40
Group variable: id                              Number of groups   =        10

R-sq:  within  = 0.4344                         Obs per group: min =         4
       between = 0.0188                                        avg =       4.0
       overall = 0.0058                                        max =         4

                                                F(6,24)            =      3.07
corr(u_i, Xb)  = -0.9510                        Prob > F           =    0.0224

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.3909016   .1662812    -2.35   0.027    -.7340892    -.047714
          DD |  -.1627207   .0922416    -1.76   0.090    -.3530981    .0276567
    Leverage |   .5068097   .4202676     1.21   0.240    -.3605801    1.374199
         ROA |   .1569654   .2060909     0.76   0.454    -.2683853    .5823161
CapExtoSales |   .3427843   .5595787     0.61   0.546    -.8121293    1.497698
          HD |   .0016818   .0926194     0.02   0.986    -.1894752    .1928387
       _cons |   8.936229   3.904217     2.29   0.031     .8783222    16.99414
-------------+----------------------------------------------------------------
     sigma_u |  .50102156
     sigma_e |  .07910783
         rho |  .97567618   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(9, 24) =     7.70               Prob > F = 0.0000
```

Table B.6 : F Test for the period of 2008-2011 with HD

```
Fixed-effects (within) regression               Number of obs      =        40
Group variable: id                              Number of groups   =        10

R-sq:  within  = 0.4565                         Obs per group: min =         4
       between = 0.0141                                        avg =       4.0
       overall = 0.0042                                        max =         4

                                                F(6,24)            =      3.36
corr(u_i, Xb)  = -0.9626                        Prob > F           =    0.0151

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.4606873     .17192    -2.68   0.013    -.8155127   -.105862
          DD |  -.1144675   .1027368    -1.11   0.276    -.3265059   .0975709
    Leverage |   .3902168   .4139787     0.94   0.355    -.4641932   1.244627
         ROA |   .2166267   .1937463     1.12   0.275     -.183246   .6164993
 CapExtoSales|   .5652837   .5774089     0.98   0.337    -.6264297   1.756997
  NextHedged |   .1375062      .1391     0.99   0.333    -.1495821   .4245946
       _cons |   10.51708   3.989088     2.64   0.014     2.284007   18.75015
-------------+----------------------------------------------------------------
     sigma_u |  .57377441
     sigma_e |   .0775454
         rho |  .98206222   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(9, 24) =      6.07              Prob > F = 0.0002
```

Table B.7 : F Test for the period of 2008-2011 with NextHedged

APPENDIX C : Results ofTime Effect Tests

```
i.t               _It_2002-2011       (naturally coded; _It_2002 omitted)

 ( 1)  _It_2003 = 0
 ( 2)  _It_2004 = 0
 ( 3)  _It_2005 = 0
 ( 4)  _It_2006 = 0
 ( 5)  _It_2007 = 0
 ( 6)  _It_2008 = 0
 ( 7)  _It_2009 = 0
 ( 8)  _It_2010 = 0
 ( 9)  _It_2011 = 0

       F(  9,    39) =    0.85
            Prob > F =    0.5739
```

Table C.1 : Time Effect Test for the period of 2002-2011 with HD

```
i.t               _It_2002-2011       (naturally coded; _It_2002 omitted)

 ( 1)  _It_2003 = 0
 ( 2)  _It_2004 = 0
 ( 3)  _It_2005 = 0
 ( 4)  _It_2006 = 0
 ( 5)  _It_2007 = 0
 ( 6)  _It_2008 = 0
 ( 7)  _It_2009 = 0
 ( 8)  _It_2010 = 0
 ( 9)  _It_2011 = 0

       F(  9,    39) =    0.99
            Prob > F =    0.4611
```

Table C.2 : Time Effect Test for the period of 2002-2011 with NextHedged

```
i.t               _It_2006-2011       (naturally coded; _It_2006 omitted)

 ( 1)  _It_2007 = 0
 ( 2)  _It_2008 = 0
 ( 3)  _It_2009 = 0
 ( 4)  _It_2010 = 0
 ( 5)  _It_2011 = 0

       F(  5,    29) =    2.19
            Prob > F =    0.0830
```

Table C.3 : Time Effect Test for the period of 2006-2011 with HD

```
i.t               _It_2006-2011       (naturally coded; _It_2006 omitted)

 ( 1)  _It_2007 = 0
 ( 2)  _It_2008 = 0
 ( 3)  _It_2009 = 0
 ( 4)  _It_2010 = 0
 ( 5)  _It_2011 = 0

       F(  5,    29) =    2.48
            Prob > F =    0.0549
```

Table C.4 : Time Effect Test for the period of 2006-2011 with NextHedged

```
i.t               _It_2007-2011       (naturally coded; _It_2007 omitted)

 ( 1)  _It_2008 = 0
 ( 2)  _It_2009 = 0
 ( 3)  _It_2010 = 0
 ( 4)  _It_2011 = 0

       F(  4,    26) =    2.09
            Prob > F =    0.1109
```

Table C.5 : Time Effect Test for the period of 2007-2011 with HD

```
i.t               _It_2007-2011       (naturally coded; _It_2007 omitted)

 ( 1)  _It_2008 = 0
 ( 2)  _It_2009 = 0
 ( 3)  _It_2010 = 0
 ( 4)  _It_2011 = 0

       F(  4,    26) =    2.95
            Prob > F =    0.0391
```

Table C.6 : Time Effect Test for the period of 2007-2011 with NextHedged

```
i.t               _It_2008-2011       (naturally coded; _It_2008 omitted)

 ( 1)  _It_2009 = 0
 ( 2)  _It_2010 = 0
 ( 3)  _It_2011 = 0

       F(  3,    21) =    1.63
            Prob > F =    0.2125
```

Table C.7 : Time Effect Test for the period of 2008-2011 with HD

```
i.t               _It_2008-2011       (naturally coded; _It_2008 omitted)

 ( 1)  _It_2009 = 0
 ( 2)  _It_2010 = 0
 ( 3)  _It_2011 = 0

       F(  3,    21) =    1.79
            Prob > F =    0.1793
```

Table C.8 : Time Effect Test for the period of 2008-2011 with NextHedged

APPENDIX D : Results of Modified Wald Test for Groupwise Heteroskedasticity

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (6)  =       73.46
Prob>chi2 =      0.0000
```

Table D.1 : Modified Wald Test for the period of 2002-2011 with HD

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (6)  =       55.68
Prob>chi2 =      0.0000
```

Table D. 2 : Modified Wald Test for the period of 2002-2011 with NextHedged

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (8)  =      137.90
Prob>chi2 =      0.0000
```

Table D.3 : Modified Wald Test for the period of 2006-2011 with HD

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (8)  =      569.75
Prob>chi2 =      0.0000
```

Table D.4 : Modified Wald Test for the period of 2006-2011 with NextHedged

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (9)  =       81.16
Prob>chi2 =      0.0000
```

Table D.5 : Modified Wald Test for the period of 2007-2011 with HD

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (9)  =      432.52
Prob>chi2 =      0.0000
```

Table D.6: Modified Wald Test for the period of 2007-2011 with NextHedged

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (10)  =     768.94
Prob>chi2 =      0.0000
```

Table D.7 : Modified Wald Test for the period of 2008-2011 with HD

```
Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (10)  =     402.54
Prob>chi2 =      0.0000
```

Table D.7 : Modified Wald Test for the period of 2008-2011 with NextHedged

APPENDIX E : Results of Autocorrelation Tests

```
FE (within) regression with AR(1) disturbances  Number of obs      =        54
Group variable: id                              Number of groups   =         6

R-sq:  within  = 0.4937                         Obs per group: min =         9
       between = 0.0761                                        avg =       9.0
       overall = 0.1129                                        max =         9

                                                F(6,42)            =      6.83
corr(u_i, Xb)  = -0.9170                        Prob > F           =    0.0000

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.5574384   .1165222    -4.78   0.000    -.7925896   -.3222871
          DD |  -.2274904   .0939941    -2.42   0.020    -.4171783   -.0378026
    Leverage |   .3537738   .3016419     1.17   0.247    -.2549641    .9625118
         ROA |   .0540139   .3148092     0.17   0.865    -.5812968    .6893246
CapExtoSales |   .2931389   .2432075     1.21   0.235    -.1976738    .7839515
          HD |   .0523267   .0669199     0.78   0.439    -.0827232    .1873765
       _cons |   12.82656   1.208755    10.61   0.000     10.3872     15.26593
-------------+----------------------------------------------------------------
      rho_ar |  .54995281
     sigma_u |  .59246957
     sigma_e |  .08803407
     rho_fov |  .97839843   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5,42) =     8.02              Prob > F = 0.0000
modified Bhargava et al. Durbin-Watson = 1.1203241
Baltagi-Wu LBI = 1.4566157
```

Table E.1 : Autocorrelation Test for the period of 2002-2011 with HD

```
FE (within) regression with AR(1) disturbances  Number of obs      =        54
Group variable: id                              Number of groups   =         6

R-sq:  within  = 0.5396                         Obs per group: min =         9
       between = 0.0990                                        avg =       9.0
       overall = 0.1387                                        max =         9

                                                F(6,42)            =      8.20
corr(u_i, Xb)  = -0.9079                        Prob > F           =    0.0000

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |   -.511061   .1010827    -5.06   0.000    -.7150541    -.307068
          DD |  -.1410223   .0979915    -1.44   0.158    -.3387772    .0567326
    Leverage |   .4930229   .2890786     1.71   0.095    -.0903614    1.076407
         ROA |   .0765434    .310922     0.25   0.807    -.5509225    .7040093
 CapExtoSales|   .1985773   .2361026     0.84   0.405     -.277897    .6750517
  NextHedged |   .1951352   .0947808     2.06   0.046     .0038598    .3864106
       _cons |   11.69481   1.206108     9.70   0.000     9.260782    14.12883
-------------+----------------------------------------------------------------
      rho_ar |  .48127096
     sigma_u |  .53418902
     sigma_e |  .08568675
     rho_fov |  .97491556   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5,42) =      8.72               Prob > F = 0.0000
modified Bhargava et al. Durbin-Watson = 1.2550181
Baltagi-Wu LBI = 1.555878
```

Table E.2 : Autocorrelation Test for the period of 2002-2011 with NextHedged

```
i.t               _It_2006-2011       (naturally coded; _It_2006 omitted)

FE (within) regression with AR(1) disturbances  Number of obs      =        40
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.6444                         Obs per group: min =         5
       between = 0.0772                                        avg =       5.0
       overall = 0.0192                                        max =         5

                                                F(10,22)           =      3.99
corr(u_i, Xb)  = -0.9452                        Prob > F           =    0.0033

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.4043938   .1763709    -2.29   0.032    -.7701645    -.038623
          DD |  -.2509976   .1113389    -2.25   0.034    -.4819002   -.0200949
    Leverage |   1.242043   .4582075     2.71   0.013     .2917788    2.192307
         ROA |  -.1810578   .3382235    -0.54   0.598    -.8824904    .5203749
 CapExtoSales|   .1312379   .4942204     0.27   0.793    -.8937124    1.156188
          HD |  -.0566333   .1077909    -0.53   0.605    -.2801779    .1669114
    _It_2007 |  -.1170947   .0545171    -2.15   0.043    -.2301562   -.0040331
    _It_2008 |   -.078968   .0613286    -1.29   0.211    -.2061558    .0482198
    _It_2009 |  -.0891604   .0605912    -1.47   0.155    -.2148189     .036498
    _It_2010 |  -.0228354   .0460888    -0.50   0.625    -.1184177    .0727468
    _It_2011 |  (omitted)
       _cons |   9.015631   3.295604     2.74   0.012     2.180966     15.8503
-------------+----------------------------------------------------------------
      rho_ar |  .18372178
     sigma_u |  .55874649
     sigma_e |  .08611057
     rho_fov |  .97679995   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(7,22) =      8.32               Prob > F = 0.0001
modified Bhargava et al. Durbin-Watson = 1.7037671
Baltagi-Wu LBI = 2.2597463
```

Table E.3 : Autocorrelation Test for the period of 2006-2011 with HD

```
i.t               _It_2006-2011       (naturally coded; _It_2006 omitted)

FE (within) regression with AR(1) disturbances  Number of obs      =        40
Group variable: id                              Number of groups   =         8

R-sq:  within  = 0.6404                         Obs per group: min =         5
       between = 0.0569                                        avg =       5.0
       overall = 0.0133                                        max =         5

                                                F(10,22)           =      3.92
corr(u_i, Xb)  = -0.9503                        Prob > F           =    0.0036

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.4316354   .1910985    -2.26   0.034    -.8279494   -.0353214
          DD |  -.2077566   .1096753    -1.89   0.071    -.4352094    .0196961
    Leverage |   1.392461   .4033664     3.45   0.002     .5559306    2.228992
         ROA |   .0210786   .3106111     0.07   0.947    -.6230895    .6652467
CapExtoSales |   .1471053   .4606424     0.32   0.752    -.8082087    1.102419
  NextHedged |   .1662909   .1535237     1.08   0.290    -.1520977    .4846795
    _It_2007 |  -.1434299   .0660257    -2.17   0.041    -.2803589   -.0065009
    _It_2008 |  -.0896319   .0617705    -1.45   0.161    -.2177361    .0384723
    _It_2009 |  -.1167386   .0569674    -2.05   0.053    -.2348817    .0014045
    _It_2010 |  -.0396633   .0486463    -0.82   0.424    -.1405495     .061223
    _It_2011 |  (omitted)
       _cons |   9.487542    4.28402     2.21   0.037     .6030274    18.37206
-------------+----------------------------------------------------------------
      rho_ar |  .01378924
     sigma_u |   .5771437
     sigma_e |  .08365903
     rho_fov |  .97942087   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(7,22) =     7.82              Prob > F = 0.0001
modified Bhargava et al. Durbin-Watson = 1.9801231
Baltagi-Wu LBI = 2.382501
```

Table E.4 : Autocorrelation Test for the period of 2006-2011 with NextHedged

```
FE (within) regression with AR(1) disturbances  Number of obs      =        36
Group variable: id                              Number of groups   =         9

R-sq:  within  = 0.4381                         Obs per group: min =         4
       between = 0.0953                                        avg =       4.0
       overall = 0.0465                                        max =         4

                                                F(6,21)            =      2.73
corr(u_i, Xb)  = -0.9585                        Prob > F           =    0.0404

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.4627456   .1997349    -2.32   0.031    -.8781171   -.0473742
          DD |  -.1855045   .1016312    -1.83   0.082    -.3968582    .0258492
    Leverage |   .4440347   .4318393     1.03   0.316    -.4540242    1.342094
         ROA |  -.0766649   .2084936    -0.37   0.717    -.5102511    .3569214
CapExtoSales |   .4327933   .6442509     0.67   0.509    -.9069998    1.772586
          HD |  -.0052405   .1089457    -0.05   0.962    -.2318054    .2213245
       _cons |   10.54528   3.350743     3.15   0.005     3.577032    17.51353
-------------+----------------------------------------------------------------
      rho_ar |  .27493233
     sigma_u |  .56193686
     sigma_e |  .08675396
     rho_fov |  .97672049   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(8,21) =     4.90              Prob > F = 0.0016
modified Bhargava et al. Durbin-Watson = 1.5343666
Baltagi-Wu LBI = 2.0372609
```

Table E.5 : Autocorrelation Test for the period of 2007-2011 with HD

```
i.t                _It_2007-2011      (naturally coded; _It_2007 omitted)

FE (within) regression with AR(1) disturbances  Number of obs      =        36
Group variable: id                              Number of groups   =         9

R-sq:  within  = 0.6129                         Obs per group: min =         4
       between = 0.0738                                        avg =       4.0
       overall = 0.0364                                        max =         4

                                                F(9,18)            =      3.17
corr(u_i, Xb)  = -0.9814                        Prob > F           =    0.0179
```

LnTobinQ	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.7701558	.2207325	-3.49	0.003	-1.233898	-.3064142
DD	-.1539088	.1162193	-1.32	0.202	-.3980766	.0902589
Leverage	.6750794	.4591839	1.47	0.159	-.2896301	1.639789
ROA	.1295278	.2432521	0.53	0.601	-.3815259	.6405815
CapExtoSales	1.049407	.6614659	1.59	0.130	-.3402814	2.439095
NextHedged	.3095588	.1731034	1.79	0.091	-.0541179	.6732355
_It_2008	-.0497557	.0556422	-0.89	0.383	-.1666557	.0671443
_It_2009	-.1169329	.0511063	-2.29	0.034	-.2243032	-.0095627
_It_2010	-.029234	.038531	-0.76	0.458	-.1101846	.0517166
_It_2011	(omitted)					
_cons	17.3703	3.792573	4.58	0.000	9.402402	25.3382
rho_ar	.24598169					
sigma_u	.88017418					
sigma_e	.07706871					
rho_fov	.99239145	(fraction of variance because of u_i)				

```
F test that all u_i=0:     F(8,18) =     5.11              Prob > F = 0.0020
modified Bhargava et al. Durbin-Watson = 1.5832012
Baltagi-Wu LBI = 2.1227796
```

Table E.6 : Autocorrelation Test for the period of 2007-2011 with NextHedged

```
FE (within) regression with AR(1) disturbances  Number of obs      =        30
Group variable: id                              Number of groups   =        10

R-sq:  within  = 0.3557                         Obs per group: min =         3
       between = 0.0382                                        avg =       3.0
       overall = 0.0184                                        max =         3

                                                F(6,14)            =      1.29
corr(u_i, Xb)  = -0.9400                        Prob > F           =    0.3241
```

LnTobinQ	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.3764337	.2497574	-1.51	0.154	-.91211	.1592426
DD	-.2140216	.1218134	-1.76	0.101	-.4752854	.0472422
Leverage	.3553753	.5845695	0.61	0.553	-.8984016	1.609152
ROA	-.8669792	.9306694	-0.93	0.367	-2.863067	1.129108
CapExtoSales	.0454814	.9758455	0.05	0.963	-2.047499	2.138462
HD	-.0228468	.1263246	-0.18	0.859	-.2937862	.2480926
_cons	8.71943	4.974295	1.75	0.101	-1.949371	19.38823
rho_ar	.14758654					
sigma_u	.46599143					
sigma_e	.09208007					
rho_fov	.96242139	(fraction of variance because of u_i)				

```
F test that all u_i=0:     F(9,14) =     4.39              Prob > F = 0.0069
modified Bhargava et al. Durbin-Watson = 1.7556085
Baltagi-Wu LBI = 2.2535745
```

Table E.7 : Autocorrelation Test for the period of 2008-2011 with HD

```
FE (within) regression with AR(1) disturbances  Number of obs      =        30
Group variable: id                              Number of groups   =        10

R-sq:  within  = 0.4243                         Obs per group: min =         3
       between = 0.0218                                        avg =       3.0
       overall = 0.0102                                        max =         3

                                                F(6,14)            =      1.72
corr(u_i, Xb)  = -0.9684                        Prob > F           =    0.1889

------------------------------------------------------------------------------
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        LnTA |  -.5534404   .2678303    -2.07   0.058    -1.127879    .0209984
          DD |  -.0907239   .1361218    -0.67   0.516    -.3826761    .2012283
    Leverage |  -.0810207   .6469568    -0.13   0.902    -1.468605    1.306564
         ROA |  -1.120459   .9702296    -1.15   0.267    -3.201394    .9604769
CapExtoSales |   .4214349   .9277217     0.45   0.657     -1.56833      2.4112
  NextHedged |   .3018542    .209508     1.44   0.172    -.1474958    .7512041
       _cons |   12.77994   5.616987     2.28   0.039     .7327042    24.82718
-------------+----------------------------------------------------------------
      rho_ar |  .09816235
     sigma_u |  .64482078
     sigma_e |  .08640494
     rho_fov |  .98236115   (fraction of variance because of u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(9,14) =     3.12               Prob > F = 0.0279
modified Bhargava et al. Durbin-Watson = 1.843964
Baltagi-Wu LBI = 2.3040778
```

Table E.8 : Autocorrelation Test for the period of 2008-2011 with NextHedged

APPENDIX F : Testing for Cross–Sectional Dependence (Breush-Pagan LM Test)

```
Correlation matrix of residuals:

         __e1     __e2     __e3     __e4     __e5     __e6
__e1   1.0000
__e2   0.5214   1.0000
__e3   0.0830   0.2703   1.0000
__e4   0.4980  -0.0955   0.1228   1.0000
__e5  -0.0474  -0.3632  -0.7552   0.0726   1.0000
__e6   0.4149   0.0244  -0.0228   0.3823  -0.0099   1.0000

Breusch-Pagan LM test of independence: chi2(15) =    16.533, Pr = 0.3475
Based on 10 complete observations
```

Table F.1 : Cross Section Dependence Test for the period of 2002-2011 with HD

```
Correlation matrix of residuals:

         __e1     __e2     __e3     __e4     __e5     __e6
__e1   1.0000
__e2   0.4909   1.0000
__e3   0.1207   0.2344   1.0000
__e4   0.4621  -0.0945   0.1860   1.0000
__e5  -0.1511  -0.4387  -0.5981  -0.1242   1.0000
__e6   0.5887  -0.0008   0.0680   0.4108  -0.0813   1.0000

Breusch-Pagan LM test of independence: chi2(15) =    16.826, Pr = 0.3294
Based on 10 complete observations
```

Table F.2 : Cross Section Dependence Test for the period of 2002-2011 with NextHedged

Correlation matrix of residuals:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8
__e1	1.0000							
__e2	-0.1336	1.0000						
__e3	0.1785	-0.2340	1.0000					
__e4	0.0250	-0.2041	0.0262	1.0000				
__e5	0.8834	-0.2958	0.2839	0.3458	1.0000			
__e6	-0.6263	0.1273	-0.6743	-0.4965	-0.8122	1.0000		
__e7	-0.3486	-0.4235	0.4239	-0.6084	-0.3932	0.3137	1.0000	
__e8	-0.2368	0.0402	-0.8073	-0.5309	-0.4207	0.8646	0.1477	1.0000

Breusch-Pagan LM test of independence: chi2(28) = 36.155, Pr = 0.1387
Based on 6 complete observations

Table F. 3: Cross Section Dependence Test for the period of 2006-2011 with HD

Correlation matrix of residuals:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8
__e1	1.0000							
__e2	-0.1135	1.0000						
__e3	0.4447	-0.0119	1.0000					
__e4	0.0588	-0.3107	-0.0486	1.0000				
__e5	0.7737	-0.3199	-0.1650	0.0119	1.0000			
__e6	-0.8413	0.2352	-0.3902	-0.5849	-0.5917	1.0000		
__e7	-0.0130	-0.2431	0.6551	-0.4180	-0.2575	0.1974	1.0000	
__e8	-0.6001	-0.2737	-0.6202	-0.4413	-0.1103	0.7634	-0.0230	1.0000

Breusch-Pagan LM test of independence: chi2(28) = 30.163, Pr = 0.3555
Based on 6 complete observations

Table F.4 : Cross Section Dependence Test for the period of 2006-2011 with NextHedged

Correlation matrix of residuals:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8	__e9
__e1	1.0000								
__e2	-0.2411	1.0000							
__e3	-0.4089	-0.3082	1.0000						
__e4	0.0521	-0.3132	-0.6580	1.0000					
__e5	0.4615	0.0276	0.0852	-0.3453	1.0000				
__e6	0.9166	-0.0797	-0.1374	-0.3502	0.5528	1.0000			
__e7	-0.5825	0.7884	0.2304	-0.5814	-0.2820	-0.2954	1.0000		
__e8	-0.2506	0.6966	-0.7106	0.3902	-0.4947	-0.3644	0.4433	1.0000	
__e9	0.0368	0.7168	0.0474	-0.7079	-0.0510	0.3395	0.7850	0.2954	1.0000

Breusch-Pagan LM test of independence: chi2(36) = 38.130, Pr = 0.3728
Based on 5 complete observations

Table F.5 : Cross Section Dependence Test for the period of 2007-2011 with HD

Correlation matrix of residuals:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8	__e9
__e1	1.0000								
__e2	-0.3296	1.0000							
__e3	-0.1512	-0.6346	1.0000						
__e4	0.4661	0.0285	0.0233	1.0000					
__e5	-0.1214	-0.4545	-0.1685	-0.4597	1.0000				
__e6	0.6791	-0.3167	-0.4919	-0.1336	0.5495	1.0000			
__e7	-0.8644	0.4248	0.2820	-0.4678	-0.2939	-0.7951	1.0000		
__e8	-0.1809	0.5487	0.0750	0.6691	-0.7865	-0.7396	0.3174	1.0000	
__e9	-0.2240	0.5948	-0.5674	-0.6912	-0.0009	0.1808	0.3745	-0.2721	1.0000

Breusch-Pagan LM test of independence: chi2(36) = 38.929, Pr = 0.3393
Based on 5 complete observations

Table F.6 : Cross Section Dependence Test for the period of 2007-2011 with NextHedged

Correlation matrix of residuals:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8	__e9	__e10
__e1	1.0000									
__e2	-0.3931	1.0000								
__e3	-0.0174	0.5036	1.0000							
__e4	-0.0213	-0.6509	-0.9732	1.0000						
__e5	0.2640	-0.1540	0.7760	-0.6374	1.0000					
__e6	0.4853	0.4089	0.8339	-0.8837	0.6533	1.0000				
__e7	0.7256	0.3451	0.4074	-0.5482	0.2110	0.8336	1.0000			
__e8	-0.7262	0.7151	-0.1592	0.0318	-0.7029	-0.3414	-0.2364	1.0000		
__e9	-0.1105	0.9542	0.6056	-0.7647	-0.0048	0.6398	0.6037	0.5020	1.0000	
__e10	-0.1177	0.3963	-0.5639	0.3686	-0.9351	-0.3431	0.1214	0.7259	0.3153	1.0000

Breusch-Pagan LM test of independence: chi2(45) = 55.714, Pr = 0.1315
Based on 4 complete observations

Table F.7 : Cross Section Dependence Test for the period of 2008-2011 with HD

Correlation matrix of residuals:

	__e1	__e2	__e3	__e4	__e5	__e6	__e7	__e8	__e9	__e10
__e1	1.0000									
__e2	-0.4296	1.0000								
__e3	-0.7483	0.2781	1.0000							
__e4	0.1709	-0.7188	-0.5423	1.0000						
__e5	0.0144	-0.1786	0.6477	-0.5268	1.0000					
__e6	-0.0623	0.6084	0.5201	-0.9881	0.6244	1.0000				
__e7	0.4824	0.5790	-0.3389	-0.6053	-0.0645	0.6043	1.0000			
__e8	-0.7354	0.6955	0.1785	-0.0657	-0.6125	-0.0886	-0.0400	1.0000		
__e9	-0.0653	0.9291	-0.0071	-0.7159	-0.2035	0.6374	0.8360	0.4740	1.0000	
__e10	-0.0856	0.4892	-0.5298	0.2115	-0.9422	-0.3286	0.3117	0.7313	0.5160	1.0000

Breusch-Pagan LM test of independence: chi2(45) = 49.931, Pr = 0.2838
Based on 4 complete observations

Table F.8 : Cross Section Dependence Test for the period of 2008-2011 with NextHedged

APPENDIX G : Estimations of Fixed Effect Models with Driscoll-Kraaystandart errors

```
Regression with Driscoll-Kraay standard errors   Number of obs     =        60
Method: Fixed-effects regression                 Number of groups  =         6
Group variable (i): id                           F(  6,      5)    =    138.96
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.5488
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.1378852	.0665694	-2.07	0.093	-.3090074	.033237
DD	-.178193	.0406331	-4.39	0.007	-.2826437	-.0737423
Leverage	.5569884	.1651904	3.37	0.020	.1323531	.9816238
ROA	.5142995	.4748502	1.08	0.328	-.7063419	1.734941
CapExtoSales	.5845842	.1196758	4.88	0.005	.2769476	.8922207
HD	-.0363061	.0359467	-1.01	0.359	-.1287101	.0560978
_cons	3.229724	1.509651	2.14	0.085	-.650959	7.110406

Table G.1 : The Output of Model1

```
Regression with Driscoll-Kraay standard errors   Number of obs     =        60
Method: Fixed-effects regression                 Number of groups  =         6
Group variable (i): id                           F(  6,      5)    =    149.83
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.5969
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.1486528	.0755028	-1.97	0.106	-.3427389	.0454333
DD	-.1005529	.0597732	-1.68	0.153	-.2542047	.0530988
Leverage	.7896355	.2187152	3.61	0.015	.2274101	1.351861
ROA	.4917811	.4198011	1.17	0.294	-.587352	1.570914
CapExtoSales	.4523648	.1301129	3.48	0.018	.117899	.7868305
NextHedged	.2598607	.0667196	3.89	0.011	.0883525	.4313688
_cons	3.270397	1.747739	1.87	0.120	-1.222308	7.763103

Table G.2 : The Output of Model2

```
i.t               _It_2006-2011       (naturally coded; _It_2006 omitted)

Regression with Driscoll-Kraay standard errors   Number of obs     =        48
Method: Fixed-effects regression                 Number of groups  =         8
Group variable (i): id                           F( 11,      7)    =     26.01
maximum lag: 2                                   Prob > F          =    0.0001
                                                 within R-squared  =    0.6002
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.2879705	.0996187	-2.89	0.023	-.5235313	-.0524097
DD	-.2276776	.0176409	-12.91	0.000	-.2693916	-.1859636
Leverage	.9943886	.2648181	3.75	0.007	.3681934	1.620584
ROA	.1396897	.2974107	0.47	0.653	-.5635748	.8429542
CapExtoSales	-.1943236	.0610116	-3.19	0.015	-.3385932	-.050054
HD	-.0051484	.0697246	-0.07	0.943	-.1700208	.1597241
_It_2007	-.1483933	.0120467	-12.32	0.000	-.1768792	-.1199074
_It_2008	-.0738366	.0237823	-3.10	0.017	-.1300727	-.0176005
_It_2009	-.1216348	.013575	-8.96	0.000	-.1537346	-.089535
_It_2010	-.0842219	.0252101	-3.34	0.012	-.1438343	-.0246094
_It_2011	-.0530332	.0314383	-1.69	0.135	-.1273728	.0213065
_cons	6.476241	2.275449	2.85	0.025	1.095659	11.85682

Table G.3 : The Output of Model3

```
i.t               _It_2006-2011       (naturally coded; _It_2006 omitted)

Regression with Driscoll-Kraay standard errors   Number of obs     =        48
Method: Fixed-effects regression                 Number of groups  =         8
Group variable (i): id                           F( 11,      7)    =   1702.83
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.6560
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.3705741	.0568258	-6.52	0.000	-.5049459	-.2362024
DD	-.1818336	.0234564	-7.75	0.000	-.2372991	-.1263681
Leverage	1.277635	.1453592	8.79	0.000	.9339152	1.621355
ROA	.1644067	.215546	0.76	0.471	-.3452785	.674092
CapExtoSales	-.2807898	.141202	-1.99	0.087	-.6146795	.0531
NextHedged	.247725	.0861111	2.88	0.024	.0441045	.4513455
_It_2007	-.1196903	.0058436	-20.48	0.000	-.1335083	-.1058723
_It_2008	-.0569507	.0216439	-2.63	0.034	-.1081304	-.0057711
_It_2009	-.104426	.0137084	-7.62	0.000	-.1368414	-.0720107
_It_2010	-.0513039	.0195831	-2.62	0.034	-.0976105	-.0049973
_It_2011	.0038247	.0148119	0.26	0.804	-.0311999	.0388493
_cons	8.140122	1.324067	6.15	0.000	5.009201	11.27104

Table G.4 : The Output of Model4

```
Regression with Driscoll-Kraay standard errors   Number of obs     =        45
Method: Fixed-effects regression                 Number of groups  =         9
Group variable (i): id                           F(  6,      8)    =   1248.40
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.5062
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.2325992	.0773156	-3.01	0.017	-.4108893	-.0543091
DD	-.1644979	.0155321	-10.59	0.000	-.2003151	-.1286807
Leverage	1.041617	.1494054	6.97	0.000	.6970877	1.386147
ROA	-.1273805	.1496118	-0.85	0.419	-.4723859	.2176248
CapExtoSales	-.2340681	.0858901	-2.73	0.026	-.432131	-.0360053
HD	-.1128568	.0584272	-1.93	0.090	-.2475902	.0218766
_cons	5.228517	1.74769	2.99	0.017	1.198336	9.258698

Table G.5 : The Ouput of Model5

```
i.t               _It_2007-2011       (naturally coded; _It_2007 omitted)

Regression with Driscoll-Kraay standard errors   Number of obs     =        45
Method: Fixed-effects regression                 Number of groups  =         9
Group variable (i): id                           F( 10,      8)    =  53169.25
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.6437
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.4071905	.0875217	-4.65	0.002	-.609016	-.205365
DD	-.2085894	.0245552	-8.49	0.000	-.2652137	-.1519651
Leverage	1.35577	.1881981	7.20	0.000	.9217845	1.789756
ROA	.1334752	.1329358	1.00	0.345	-.1730752	.4400257
CapExtoSales	.1901951	.0862817	2.20	0.059	-.0087708	.3891611
NextHedged	.1402855	.0791008	1.77	0.114	-.0421212	.3226922
_It_2008	.0603719	.0185207	3.26	0.012	.017663	.1030808
_It_2009	.01824	.0119003	1.53	0.164	-.0092021	.045682
_It_2010	.1085864	.0102032	10.64	0.000	.0850577	.132115
_It_2011	.1373205	.0130236	10.54	0.000	.1072882	.1673529
_cons	8.852322	2.027702	4.37	0.002	4.176431	13.52821

Table G.6 : The Output of Model6

```
Regression with Driscoll-Kraay standard errors   Number of obs     =        40
Method: Fixed-effects regression                 Number of groups  =        10
Group variable (i): id                           F(  6,      9)    =      5.08
maximum lag: 1                                   Prob > F          =    0.0153
                                                 within R-squared  =    0.4344
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.3909016	.1306681	-2.99	0.015	-.6864933	-.09531
DD	-.1627207	.0195324	-8.33	0.000	-.206906	-.1185355
Leverage	.5068097	.2115447	2.40	0.040	.0282622	.9853571
ROA	.1569654	.0989054	1.59	0.147	-.0667742	.380705
CapExtoSales	.3427843	.1689177	2.03	0.073	-.0393342	.7249028
HD	.0016818	.034776	0.05	0.962	-.0769871	.0803506
_cons	8.936229	3.078306	2.90	0.018	1.972618	15.89984

Table G.7 : The Output of Model7

```
Regression with Driscoll-Kraay standard errors   Number of obs     =        40
Method: Fixed-effects regression                 Number of groups  =        10
Group variable (i): id                           F(  6,      9)    =      4.47
maximum lag: 1                                   Prob > F          =    0.0225
                                                 within R-squared  =    0.4565
```

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
LnTA	-.4606873	.0479077	-9.62	0.000	-.5690621	-.3523126
DD	-.1144675	.0482445	-2.37	0.042	-.2236042	-.0053308
Leverage	.3902168	.0861339	4.53	0.001	.1953684	.5850652
ROA	.2166267	.1198708	1.81	0.104	-.05454	.4877934
CapExtoSales	.5652837	.3702174	1.53	0.161	-.2722062	1.402774
NextHedged	.1375062	.1436805	0.96	0.364	-.1875216	.4625341
_cons	10.51708	1.13356	9.28	0.000	7.95279	13.08137

Table G.8 : The Output of Model8

APPENDIX H : Estimations of Dynamic Fixed Effect Models with Driscoll-Kraaystandart errors

```
Regression with Driscoll-Kraay standard errors   Number of obs     =        59
Method: Fixed-effects regression                 Number of groups  =         6
Group variable (i): id                           F(  7,      5)    =    515.17
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.5687

------------------------------------------------------------------------------
             |             Drisc/Kraay
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lagLnTobinQ |   .1426811   .0928652     1.54   0.185    -.0960365    .3813987
        LnTA |  -.1475069   .0638006    -2.31   0.069    -.3115115    .0164978
          DD |  -.1660053   .0294795    -5.63   0.002    -.2417848   -.0902259
    Leverage |   .4770404   .1600828     2.98   0.031     .0655344    .8885463
         ROA |   .3643189    .502723     0.72   0.501    -.9279718     1.65661
CapExtoSales |   .5190227   .1499704     3.46   0.018     .1335115    .9045339
          HD |  -.0307769   .0369738    -0.83   0.443    -.1258211    .0642674
       _cons |   3.431596   1.437159     2.39   0.063    -.2627386    7.125932
------------------------------------------------------------------------------
```

Table H. 1 : The Output of Model9

```
Regression with Driscoll-Kraay standard errors   Number of obs     =        59
Method: Fixed-effects regression                 Number of groups  =         6
Group variable (i): id                           F(  7,      5)    =    961.40
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.6197

------------------------------------------------------------------------------
             |             Drisc/Kraay
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lagLnTobinQ |   .1430935    .079325     1.80   0.131    -.0608178    .3470048
        LnTA |  -.1569885   .0709179    -2.21   0.078    -.3392888    .0253117
          DD |   -.086514   .0497378    -1.74   0.142    -.2143691    .0413411
    Leverage |   .7042905   .2237712     3.15   0.025     .1290683    1.279513
         ROA |   .3070762   .3958586     0.78   0.473    -.7105108    1.324663
CapExtoSales |   .3889946   .1529739     2.54   0.052    -.0042372    .7822265
  NextHedged |    .267699   .0726018     3.69   0.014       .08107    .4543279
       _cons |   3.446549   1.653954     2.08   0.092    -.8050745    7.698172
------------------------------------------------------------------------------
```

Table H. 2 : The Output of Model10

```
i.t               _It_2006-2011       (naturally coded; _It_2006 omitted)

Regression with Driscoll-Kraay standard errors   Number of obs     =        47
Method: Fixed-effects regression                 Number of groups  =         8
Group variable (i): id                           F( 12,      7)    =    104.82
maximum lag: 2                                   Prob > F          =    0.0000
                                                 within R-squared  =    0.6527

------------------------------------------------------------------------------
             |             Drisc/Kraay
    LnTobinQ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
 lagLnTobinQ |  -.2494095   .0473686    -5.27   0.001    -.3614184   -.1374006
        LnTA |  -.2554607   .1045007    -2.44   0.044    -.5025656   -.0083559
          DD |  -.2158169    .018307   -11.79   0.000    -.2591061   -.1725277
    Leverage |   1.203864   .2202091     5.47   0.001     .6831525    1.724576
         ROA |   .2038483   .2457678     0.83   0.434    -.3773003    .7849968
CapExtoSales |  -.3822982    .099399    -3.85   0.006    -.6173395   -.1472569
          HD |  -.0322811   .0693561    -0.47   0.656    -.1962822      .13172
    _It_2007 |  -.1243483   .0172806    -7.20   0.000    -.1652105   -.0834861
    _It_2008 |   -.107886   .0239794    -4.50   0.003    -.1645884   -.0511837
    _It_2009 |  -.1323602   .0227022    -5.83   0.001    -.1860423   -.0786781
    _It_2010 |  -.1104889   .0410542    -2.69   0.031    -.2075666   -.0134111
    _It_2011 |   -.082156    .048388    -1.70   0.133    -.1965754    .0322633
       _cons |   5.766271   2.295182     2.51   0.040     .3390276    11.19351
------------------------------------------------------------------------------
```

Table H. 3 : The Output of Model11

i.t _It_2006-2011 (naturally coded; _It_2006 omitted)

Regression with Driscoll-Kraay standard errors
Method: Fixed-effects regression
Group variable (i): id
maximum lag: 2

Number of obs = 47
Number of groups = 8
F(12, 7) = 253.89
Prob > F = 0.0000
within R-squared = 0.6813

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
lagLnTobinQ	-.1790828	.0278353	-6.43	0.000	-.2449028	-.1132627
LnTA	-.384018	.0756758	-5.07	0.001	-.5629627	-.2050732
DD	-.1930249	.019781	-9.76	0.000	-.2397994	-.1462503
Leverage	1.327688	.1417083	9.37	0.000	.9926006	1.662775
ROA	.234716	.1731475	1.36	0.217	-.1747127	.6441447
CapExtoSales	-.3254126	.1561003	-2.08	0.076	-.6945312	.0437059
NextHedged	.2068292	.0846458	2.44	0.045	.0066736	.4069848
_It_2007	-.0916432	.0218511	-4.19	0.004	-.1433128	-.0399737
_It_2008	-.0611514	.0345034	-1.77	0.120	-.142739	.0204362
_It_2009	-.0920384	.0286632	-3.21	0.015	-.1598161	-.0242607
_It_2010	-.0477423	.0369654	-1.29	0.238	-.1351515	.0396668
_It_2011	.0046073	.0415528	0.11	0.915	-.0936494	.102864
_cons	8.45956	1.67145	5.06	0.001	4.50721	12.41191

Table H. 4 : The Output of Model12

i.t _It_2007-2011 (naturally coded; _It_2007 omitted)

Regression with Driscoll-Kraay standard errors
Method: Fixed-effects regression
Group variable (i): id
maximum lag: 2

Number of obs = 44
Number of groups = 9
F(11, 8) = 189.33
Prob > F = 0.0000
within R-squared = 0.6823

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
lagLnTobinQ	-.2424907	.0485484	-4.99	0.001	-.3544435	-.1305379
LnTA	-.4826527	.0297584	-16.22	0.000	-.5512758	-.4140297
DD	-.265631	.0057359	-46.31	0.000	-.278858	-.252404
Leverage	1.357722	.1330093	10.21	0.000	1.051002	1.664442
ROA	.2476762	.1379855	1.79	0.110	-.0705188	.5658712
CapExtoSales	.0675469	.0875569	0.77	0.463	-.1343596	.2694534
HD	-.0175113	.0525983	-0.33	0.748	-.1388031	.1037805
_It_2008	.0625322	.0146588	4.27	0.003	.0287288	.0963355
_It_2009	.0424119	.0050016	8.48	0.000	.0308781	.0539457
_It_2010	.1209805	.0091377	13.24	0.000	.0999089	.1420521
_It_2011	.1504646	.0126288	11.91	0.000	.1213426	.1795865
_cons	10.65245	.6652958	16.01	0.000	9.118274	12.18662

Table H. 5 : The Ouput of Model13

i.t _It_2007-2011 (naturally coded; _It_2007 omitted)

Regression with Driscoll-Kraay standard errors
Method: Fixed-effects regression
Group variable (i): id
maximum lag: 2

Number of obs = 44
Number of groups = 9
F(11, 8) = 219.83
Prob > F = 0.0000
within R-squared = 0.6905

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
lagLnTobinQ	-.2146087	.0378583	-5.67	0.000	-.3019101	-.1273073
LnTA	-.5091089	.0570439	-8.92	0.000	-.6406525	-.3775653
DD	-.2391899	.0300015	-7.97	0.000	-.3083734	-.1700064
Leverage	1.421468	.1484193	9.58	0.000	1.079213	1.763724
ROA	.2669161	.103785	2.57	0.033	.0275875	.5062447
CapExtoSales	.1429852	.0961669	1.49	0.175	-.078776	.3647463
NextHedged	.1031238	.0975121	1.06	0.321	-.1217395	.327987
_It_2008	.0651654	.018009	3.62	0.007	.0236367	.1066941
_It_2009	.0398181	.0100469	3.96	0.004	.0166499	.0629863
_It_2010	.1269352	.009129	13.90	0.000	.1058836	.1479867
_It_2011	.1625534	.0160065	10.16	0.000	.1256423	.1994646
_cons	11.16773	1.276871	8.75	0.000	8.223262	14.1122

Table H. 6 : The Output of Model14

i.t _It_2008-2011 (naturally coded; _It_2008 omitted)

Regression with Driscoll-Kraay standard errors	Number of obs	=	39
Method: Fixed-effects regression	Number of groups	=	10
Group variable (i): id	F(10, 9)	=	145.01
maximum lag: 1	Prob > F	=	0.0000
	within R-squared	=	0.5986

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
lagLnTobinQ	-.0787838	.0817325	-0.96	0.360	-.2636756	.106108
LnTA	-.5146221	.06283	-8.19	0.000	-.6567534	-.3724908
DD	-.2547317	.0238298	-10.69	0.000	-.3086386	-.2008249
Leverage	1.178191	.1674017	7.04	0.000	.7995021	1.55688
ROA	.1055654	.0446729	2.36	0.042	.0045083	.2066224
CapExtoSales	.2399308	.0995166	2.41	0.039	.0148086	.465053
HD	.0699045	.0151649	4.61	0.001	.0355992	.1042099
_It_2009	-.009011	.0009938	-9.07	0.000	-.0112591	-.0067629
_It_2010	.0865179	.0093587	9.24	0.000	.065347	.1076888
_It_2011	.1021779	.0151398	6.75	0.000	.0679294	.1364264
_cons	11.44391	1.419117	8.06	0.000	8.233645	14.65418

Table H. 7 : The Output of Model15

i.t _It_2008-2011 (naturally coded; _It_2008 omitted)

Regression with Driscoll-Kraay standard errors	Number of obs	=	39
Method: Fixed-effects regression	Number of groups	=	10
Group variable (i): id	F(10, 9)	=	400.76
maximum lag: 1	Prob > F	=	0.0000
	within R-squared	=	0.6423

LnTobinQ	Coef.	Drisc/Kraay Std. Err.	t	P>|t|	[95% Conf.	Interval]
lagLnTobinQ	-.1273057	.0848988	-1.50	0.168	-.3193601	.0647486
LnTA	-.7058023	.0625918	-11.28	0.000	-.8473948	-.5642098
DD	-.1931691	.0542534	-3.56	0.006	-.3158988	-.0704394
Leverage	.9491465	.2117441	4.48	0.002	.4701479	1.428145
ROA	.0520385	.0309559	1.68	0.127	-.0179887	.1220656
CapExtoSales	.5995721	.2070152	2.90	0.018	.1312712	1.067873
NextHedged	.2310774	.14734	1.57	0.151	-.1022287	.5643835
_It_2009	.0137661	.0114826	1.20	0.261	-.0122094	.0397416
_It_2010	.1034874	.0073882	14.01	0.000	.0867742	.1202006
_It_2011	.1346187	.0163286	8.24	0.000	.0976808	.1715566
_cons	15.85354	1.421396	11.15	0.000	12.63812	19.06897

Table H. 8 : The Output of Model16

APPENDIX I : The Replacement Method for Airtran Airways Data as of 2011

t: {2002, …., 2011}

i:{Sales, Depreciation and Amortization, Net Income (Loss), Current Assets, Inventories, Total Assets, Short Term Liabilities, Long Term Debt, Shareholder's Equity, Capital Expenditure, Market Value of Common Stock}

$X_{t,i}^{A}$: i[th] variable of Airtran Airways for the year of t.

$X_{t,i}^{S}$: i[th] variable of Southwest Airlines for the year of t.

$$(X_{t,i}^{A})^{*} = X_{2011,i}^{A} \frac{\frac{\sum_{2002}^{2010}\sum_{i}^{11} X_{t,i}^{A}}{n}}{\frac{\sum_{2002}^{2010}\sum_{i}^{11} X_{t,i}^{S}}{n}} \quad \textbf{(I.1)}$$

$$(X_{2011,i}^{S})^{*} = X_{2011,i}^{S} - (X_{2011,i}^{A})^{*} \quad \textbf{(I.2)}$$

APPENDIX J : The Aggregation Rule

t: {2002, …, 2011}; i: {American, Continental, Southwest, JetBlue, Alaska, Airtran}

t: {2006,…., 2011}; i: { American, Continental, Southwest, JetBlue, Alaska, Airtran, US Airways, Hawaiian}

t: {2007,…., 2011}; i: { American, Continental, Southwest, JetBlue, Alaska, Airtran, US Airways, Hawaiian, United}

t: {2008,…., 2011}; i: { American, Continental, Southwest, JetBlue, Alaska, Airtran, US Airways, Hawaiian, United, Delta}

v: {ROA, Levarage, CapExtoSales, NextHedged, Tobin's Q, Total Assets, Avg. Fuel Cost % of Operating Expense}

$W_{i,t}$: i^{th} airline's weight for year t.

$TA_{i,t}$: i^{th} airline's Total Asstes for year t.

X_{it}^{v}: i^{th} airline's v^{th} variable for year t.

$[X_t^v]^{agg}$: the aggregated value of v^{th} variable for year t.

$$W_{i,t} = \frac{TA_{i,t}}{\sum_i^n TA_{i,t}} \quad (J.1)$$

$$[X_t^v]^{agg} = \sum_i^n W_{i,t} \times X_{i,t}^{v} \quad (J.2)$$

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