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# DIAMONDS ARE FOREVER, WARS ARE NOT: IS CONFLICT BAD FOR PRIVATE FIRMS?

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## ABSTRACT

# Diamonds are Forever, Wars are Not: Is Conflict Bad for Private Firms?*

This Paper studies the relationship between civil war and private investment in a poor, resource abundant country using microeconomic data for Angola. We focus on diamond mining firms and conduct an event study on the sudden end of the conflict, marked by the death of the rebel movement leader in 2002. We find that the stock market perceived this event as 'bad news' rather than 'good news' for companies holding concessions in Angola, as their abnormal returns declined by 4 percentage points. The event had no effect on a control portfolio of otherwise similar diamond mining companies. This finding is corroborated by other events and by the adoption of alternative methodologies. We also use nonparametric techniques with daily data on the intensity of conflict, and find that moderate levels of violence increased the abnormal returns of the 'Angolan' portfolio. We interpret our results in the light of the widespread rent seeking in the Angolan mineral industry.

JEL Classification: G14, O12 and O16
Keywords: Angola, civil war, event studies and rent-seeking

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## 1. **Introduction**

The relationship between civil war and economic growth has recently come to the forefront of the economic debate due to an increased number of conflicts in recent years and to the dismal economic performance of many developing countries plagued by internal wars, most notably African countries. The starting point is the notion that political instability discourages private investment, and lower investment rates in turn imply lower growth. At the empirical level, the negative relationship between political instability and investment has been documented mainly in cross country studies, e.g., Alesina and Perotti (1996) and Svensson (1998), that cover both developing and industrialized countries using macroeconomic data.

A notable exception is the paper by Abadie and Gardeazabal (2003), which employs microeconomic data but focuses on an industrialized region, the Basque Country. Our paper is an attempt to assess the relationship between conflict and private investment using microeconomic data and focusing on a poor country. In fact, most contemporary conflicts occur in poor regions and supposedly these regions are the ones that would need investment and growth the most. Most importantly, the role played by uncertainty in rich, market oriented economies may differ from that played in highly regulated, poor countries. We find that indeed the conflict-investment relationship is context-specific: our results differ markedly from those obtained in the above studies, suggesting that in certain economies conflicts may be perceived as *beneficial* to investors.

We focus on the civil war that has plagued Angola since independence and on one of the sectors that have been most affected by this conflict, namely diamond production, to explore investors' reactions to changes in the intensity of the conflict. We cover the last phase of the war, i.e., the period 1998-2002. Angola's civil war is an interesting case-study for at least two reasons. First, it is a typical "resource war", as both the government party (MPLA) and the rebel movement (UNITA) financed the war exploiting natural resources (i.e., oil and diamonds, respectively). Secondly, and most relevant from a methodological point of view, the Angolan civil war suddenly ended with the death of the rebels' leader, Jonas Savimbi, on February 22, 2002. This allows us to conduct an event study to assess investors' reactions to an exogenous conflict-related event, and one in which one party gained an unambiguous victory over the other. The traded stocks we use for our event study are those of diamond mining companies holding concessions in Angola. Restricting our analysis to the diamonds sector is useful because, differently from oil production sites that are located offshore and were removed from the fighting in the mainland, the activities of diamond extracting firms were located in areas very much at the center of the conflict. A priori, one would therefore expect the (negative) impact of the war to be maximal on these firms. We also construct a "control portfolio" made of otherwise similar diamond mining companies *not* holding concessions in Angola, and conduct our event studies on this portfolio as well.

Our main finding is that the cumulative abnormal returns of "Angolan" stocks experienced a significant drop in correspondence to the end of the conflict, while those in the control portfolio did not. In other words, *Savimbi's death (and later the cease-fire) was perceived by stock markets as "good news" for the companies operating in Angola, but not for the others.* On the event date, the abnormal returns of the "Angolan" portfolio declined by 4 percentage points, and the difference between "Angolan" and control abnormal returns was $-.07$. We suggest three potential explanations"for this finding: the potential entry

of new diamond producers, the potential drop in world diamond prices, and the increased rent extraction ability of the Angolan government at the end of the conflict. The lack of transparency in the licensing process and other characteristics of the Angolan diamond sector make this last channel particularly plausible. In other words, civil war created an environment in which neither party could fully monopolize the management of natural resources, and this the scope for rent extraction. Finally, to extend our analysis to "continuous" indicators of the intensity of conflict, we collect daily data on military attacks and war related casualties, and estimate the relationship between political tension and firm value using nonparametric techniques. We find that this relationship has an inverted-U shape for the "Angolan" portfolio and is basically flat for the control one, suggesting that intermediate levels of conflict are perceived as "good news" by investors.

A cynical reader of our results may take the popular street saying during the 1992 presidential elections in Angola"– "The MPLA steals, UNITA kills" – and say that our findings cast doubt on whether killing was perceived as worse than stealing by private investors. We are aware that our"findings may be specific to the Angolan context, but we believe it is important to call attention to the fact that political economy and rent seeking considerations often play a leading role together with the sheer uncertainty generated by conflict. Political instability may present advantages for private businesses in certain economic environments, environments which are rather different from the industrialized economies for which most of the consensus was built.

This paper is related to two strands of the literature. The first is a growing body of work that has applied the event study framework not to firm specific or economic announcements (as is traditionally done in the finance literature), but to political events. Notable examples are Roberts (1990), Fisman (2001), and Johnson and Mitton (2003). These studies examine events that affected specific political figures, such as the US Senator Henry Jackson, the Indonesian President Suharto, or the Malaysian Prime Minister Mahathir, to estimate their impact on companies that had different degrees of political connections with those figures. Starting from a prior on which companies were more or less connected to leading personalities, these papers "attach a price tag" on the value of political connections.

Our analysis differs from these papers in two respects. First, our goal is not to quantify the extent of corruption but to understand the consequences of civil conflict. We have no prior on which companies have links with particular political figures or parties and we consider events that do not target specific politicians but affect conflict in general. Secondly, we allow for political tension not to have uniformly "positive" or "negative" effects and using continuous indicators of tension we estimate a nonlinear relationship between the intensity of conflict and company abnormal returns. Within the event study approach, the closest work to ours is the study of conflict in the Basque region by Abadie and Gardeazabal (2003). The authors compare the per capita GDP in the Basque region with that of a 'synthetic' control region that had similar characteristics at the onset of the conflict, and find that the Basque region has performed significantly worse after the start of the conflict. Furthermore, they conduct an event study on the announcement (and subsequent end) of a cease-fire by ETA between 1998 and 1999, and find that only the stocks of firms whose business activities in the Basque Country were significant showed a positive response to the cease-fire. The main difference between their study and ours lies in the economic environment under

consideration. An analysis of the Angolan economy requires political economy considerations (together with sheer uncertainty) that create a non-monotonic relationship between conflict and stock performance. Differently from Abadie and Gardeazabal (2003), we thus find a *positive* relationship between conflict and firm value, and estimate a nonlinear relationship using continuous indicators of conflict.

The second branch of the literature related to our work concerns the role of natural resources in civil wars. The hypothesis that natural resource abundance may trigger the onset of conflict was first tested with cross country data by Collier and Hoeffler (1998). Using the ratio of primary exports to GDP as a proxy for natural resource endowments, the authors found that it had a positive (nonlinear) impact on the likelihood of war. Several studies have followed, expanding the analysis to the duration as well as the onset of conflict, and the results have been contrasting depending on the coding of the civil war variable, on the proxy for natural resource endowments, and on the specification used.[1] Our paper has nothing to say about whether diamond wealth triggered or not civil war in Angola. Our focus is on the *effects* of war, rather than on its determinants. However, natural resources come into play because we argue that conflict and political instability in resource abundant economies play a different role than it is generally assumed, due to the particular governance structure that such economies may develop. In a very interesting case study of Angola, Le Billon (2000) argued that narrow and mostly foreign-dominated resource industries, such as the oil and the diamond sector, generated huge economic rents that were appropriated by the political elite. We claim that this is an important element to consider when assessing how the Angolan war was perceived by investors, and we try to provide empirical evidence in support of this claim.

The remainder of the paper is organized as follows. In section 2 we briefly sketch the key features of the Angolan civil conflict and the way in which the diamond industry is organized in Angola. Section 3 presents our main empirical results, using the event study methodology. In section 4 we estimate the relationship between firm value and a continuous index of tension using a nonparametric regression framework. Finally, section 5 concludes.

## 2. **Civil war and the diamond industry in Angola**

Since its independence from Portugal in 1974, Angola"has been plagued by a long"and cruel civil war between the Movimento Popular de Libertaçao de Angola (MPLA) and the Uniao Nacional para a Independencia Total de Angola (UNITA). The early stages of this conflict belong to the Cold War period, which saw the former URSS backing the Marxist-Leninist MPLA, and the US and South Africa supporting UNITA. In September 1992, national elections were held and José Eduardo dos Santos, leader of MPLA, won by a slight margin. This victory was never recognized by UNITA's leader, Jonas Savimbi, who started fighting a war that was perceived by many as driven by his own desire of political power as much as by ideology.

Since the early 1990s, UNITA's strategy was aimed at occupying the areas of highest concentration of diamond mines (e.g., the Lunda Norte province and the Cuango Valley), and at using diamond sales to finance weapons purchases. On the other hand, while earning money from official diamond concessions, the MPLA mostly relied on oil for financing its military operations through the Fuerzas Armadas de

[1] For a comprehensive review of these studies, see Ross (2004).

Angola (FAA). Between the end of 1992 and the end of 1994 UNITA occupied several large cities and the key diamond producing regions, managing to control a large fraction of Angolan diamond production. However, increased earnings from oil allowed the government to gain military advantage and led UNITA to sign the Lusaka Protocol, supposedly starting a peace process. In acknowledgment of UNITA's presence in the diamond sector and as part of the negotiations, UNITA was given legal rights to mine and to form partnerships with other companies. It was soon clear that Savimbi had no intention to comply with the requirements of the Protocol, and the peace process finally collapsed in the Summer of 1998, when the rebels returned to massive attacks against military and civilians. The years between 1998 and February 2002 marked the last phase of the Angolan conflict, which officially ended on April 4, 2002, six weeks after the death of Jonas Savimbi.

During those last four years there was a gradual change in the military strategy of the rebel movement. Between December 1997 and the first months of 1998, UNITA had handed over to the government some of the areas it previously occupied, gaining time to reorganize and re-arm. Between May 1998 and the Summer of the same year, there was an escalation of attacks by UNITA, and Savimbi re-conquered many of the areas previously handed over to the government. By July 1998 the country was back to full scale war, and in the following months the rebels put under siege several strategic towns controlled by the government. The FAA counter-offensive started in mid-September 1999. By the end of October, the government had taken control of Andulo and Bailundo, UNITA's strongholds in the Central Highlands. A series of military defeats induced the rebels to revert to hit and run tactics, to divert FAA efforts away from large concentrations of UNITA soldiers. Notably, Savimbi's army had not been pushed out of Lunda Norte, the province with highest diamond concentration, and could still conduct some mining operations. From May 2001 onwards, kidnapping and murders by UNITA soldiers increased sharply, usually through the deliberate attack of civilian targets. The shift to a terror strategy was motivated by the attempt to divert the FAA from UNITA's locations, by the hope to trigger another round of negotiations, but also by the sheer need to obtain food and other supplies at a time when most of the rebels' traditional supply routes had been interrupted. Throughout these years, many commentators talked about a "military stalemate" and there was no clear consensus on the likelihood of a government victory. Between December 2001 and January 2002, however, a number of senior UNITA officers were captured and this event spread the perception that the FAA was close to Savimbi's military column. On February 22 Jonas Savimbi died in an ambush 100 kilometers from the Zambian border. To assert the unequivocal victory in contrast to previous instances in which the government had claimed to have killed or wounded the rebel leader, Savimbi's body was put on display for journalists in a nearby town. On April 4, the cease-fire (Luena Memorandum of Understanding) was officially signed by the leaders of the FAA and of UNITA's military wing.

Since the beginning of the war, there has been a close link between conflict and the diamond industry in Angola. The key role of diamond sales in financing UNITA's operations has brought the problem of "conflict diamonds" to the attention of the public. Despite the imposition of UN sanctions against purchases of diamonds illegally mined in Angola, the difficulty of ascertaining the origin of the stones and the huge profits to be made by trading Angolan gems have allowed the rebel movement to rely on national

and international informal networks to sell its production through the end of the war. To give an idea of the importance of the sector, Angola is the fourth largest diamond producer by value in the world, after Botswana, Russia and South Africa. Counting official as well as unofficial production, Angolan diamond sales in 2000 reached $1.1 billion, i.e. 15 percent of the world production of rough diamonds. This total amount was almost equally split between official industrial production ($368 million), official artisanal production¨($371 million), and illegal production ($350 million). It is estimated that between 1992 and 1997, when UNITA controlled most deposits in the Cuango valley, the rebel movement supplied between 8 and 10 percent of the rough diamonds by value on the world market.[2]

Angola's importance on the world markets is largely due to the fact that most of its diamond production is of gem quality, as opposed to industrial quality, with an average value of $127 per carat in 2002.[3] Angolan diamonds have traditionally been mined mostly in alluvial deposits, i.e., with relatively minor capital requirements compared to kimberlite pipes. Capital investments in alluvial production have generally been in the form of light machinery and river diversions. During the colonial period, diamond production in Angola was marketed through De Beers' Central Selling Organization (CSO). In 1986, the state-owned Empresa Nacional de Diamantes de Angola (Endiama) was created to control the production and marketing of Angolan diamonds, and the contract with the CSO was terminated. The system that was set up was one in which industrial mining companies entered production sharing arrangements with Endiama, which took care of the marketing. Foreign companies could freely repatriate their profits. In concomitance with the Lusaka Peace protocol, the government expected an increase in investments and in 1994 a new diamond law was passed which introduced heavier regulation. The corporate tax rate was set at 40% of net profits, plus 5% royalties and a surface tax proportional to the area of the concession to be paid during the exploration stages. More"importantly, the law established that mining rights would be awarded by the Council of Ministers only to"joint ventures including Endiama. If a foreign company wanted a concession, it should form a partnership with an Angolan company (as well as with Endiama), and get the further approval of the Ministry of Geology and Mines. Specifically, Law 16/94 established that "the participation of Angolan companies should be encouraged, as long as they possess the required technical and financial conditions" (article 2.6). This led to the proliferation of local mining companies owned by well connected Angolan politicians and military officials, who obtained concession rights for nominal fees and then sought lucrative partnerships with foreign companies.[4] As we shall see below, the entity of these hidden costs, together with the need to hire expensive private security firms, has restricted participation into diamond mining in Angola to a relatively small number of industrial companies and a large number of artisanal miners (*garimpeiros*).

Between December 1999 and February 2000, the Angolan diamond industry underwent substantial restructuring. First of all, the government created a marketing monopoly in which all Angolan diamond production would be bought and re-sold by the Angola Selling Corporation (Ascorp). This was a joint venture between the state-owned Sodiam (51%) and two foreign companies with strong political connec-

[2]Source: Hodges (2004), pp.174-177.

[3]Source: George Coakley, *The Mineral Industry of Angola 2002*, in USGS Minerals Yearbook.

[4]For a detailed list of companies, the reader is referred to Chilliers and Dietrich (2000), ch. 7.

tions.[5] The creation of Ascorp was perceived as a serious blow to major international companies operating in Angola, first of all to De Beers who saw its contract for marketing the production of the main Cuango Valley concession suspended, and started a legal action against the Angolan government. Another reform in early 2000 implied a major restructuring of existing diamond concessions. The government suspended all contracts that had been signed between Endiama and other mining companies and introduced a new law to regulate diamond production. It was established that no concession should exceed 3,000 square kilometers, and that current concessions exceeding this size would be divided and assigned to other prospectors. Even concessions smaller than the maximum size could be expropriated, if it was proved that the current holder was not prospecting the entire area. While the stated goal of this policy was to regularize illegal mining activity that was going on in large concessions, the reform was not welcomed by existing companies who saw their contracts unilaterally renegotiated.

After the end of the war the situation has not changed significantly. Partnerships with local companies remain a cornerstone of Angolan diamond industry, and Sodiam is still marketing the production of larger mining companies in the formal sector. Furthermore, the government has established a security body that has been seen by many as an attempt to centralize control of diamond production under domestic intelligence services.

## 3. **Conflict and stock market reactions: event study approach**

In this section we start by testing the widely held notion that increases in the intensity of conflict, by increasing operational costs and uncertainty on the possibility that local mining companies can operate their concessions, should reduce the value of such companies. This idea can be formalized with a simple intertemporal model in which the firm's expected cash flow is an increasing function of the likelihood that the war ends, either because of the reduction in uncertainty or because during the war infrastructure is damaged and production costs increase.[6] If this simple model is correct, the end of the conflict should unambiguously be good news for the company. To test whether this is the case, we look at the prices of publicly traded diamond mining companies operating in Angola and conduct an event study.

### 3.1. *Methodology*

Following a vast literature, reviewed by Campbell et al. (1997), we take as a benchmark the market model:

$$r_t = \alpha + \beta r_t^M + e_t,$$

where $r_t$ is the daily rate of return on the company's stock (defined as the percentage change in the price of one share of stock), $r_t^M$ is the return on the market portfolio, and $e_t$ is an unexplained residual called

[5] These are the Israeli company Welox (24.5%) and the Belgian company Tais (24.5%). The owner of Welox had a well known alliance with the vice-minister for mining and geology, as well as with a Russian businessman who helped dos Santos renegotiate Angola's debt to Russia. The main stakeholder of Tais was in business with Isabel dos Santos, the President's daughter.

[6] In the years of the most intense fighting in Angola, numerous companies lamented prohibitive production costs related to the fact that roads were inaccessible and all supplies had to be brought in by air. As for damages to the infrastructure, below we discuss examples of mining sites attacked by the rebel movement.

the *abnormal return*. We augment this model as follows:

$$r_t = \alpha + \beta r_t^M + \theta S_t + e_t \tag{1}$$

where $S_t$ represents a set of dummies for company-specific events that may influence the returns on the stock. Such events include announcements and implementations of: mergers and acquisitions, stock splits, joint ventures, temporary delisting, evaluations by the stock market regulation authorities, new mining licenses obtained, and discovery of new mineral resources. We introduce these dummies for the dates on which such non-political events occur in order to filter out changes in stock price that are unrelated to (Angolan) political events. Our"objective thus becomes to estimate the relationship between the estimated abnormal return $e_t$ from (1) and changes in political tension.

The event study approach relies on the observation that, if security prices reflect the present discounted value of the long-run stream of cash flows generated by an asset, the measurement of the economic effects of political tension can be performed by looking at changes of asset prices that occur in connection with particular tension episodes.[7] In our event study, we follow the standard methodology presented, among others, by Campbell et al. (1997). For each event, we use several *event windows*, i.e. intervals of time over which markets are likely to have incorporated changing expectations as a consequence of the event. A generic event window, which we denote with $[-x, +y]$, includes the day in which the event has been reported by the media (say, $t_0$) together with $x$ days before and $y$ days after. We have constructed symmetric as well as asymmetric windows, to account for the possibility that the event may be anticipated by investors (or reported late by the press), as well as for the possibility that markets' reaction continues for an extended period after the event date.[8]

The series of abnormal returns for a given security is generated by estimating model (1) by OLS using two alternative fixed-length *estimation windows* $T$, namely $T = 24$ and $T = 63$ trading days before the start of the event window used. We take as a benchmark the 24-day window and use the 63-day one for sensitivity analysis. The choice of a relatively short window is due to the high frequency of salient political events in Angola in the period under consideration, and the need not to include such events in the sample used to estimate the "normal" (pre-event) model. Denoting with $t_0 - k$ ($k = 0, 1, 3, 5, 10$) the first day of the chosen event window, we thus estimate (1) on the sample that goes from $t_0 - k - T$ to $t_0 - k - 1$. We take the estimated parameters $\widehat{\alpha}$, $\widehat{\beta}$ and $\widehat{\theta}$ to calculate the series of abnormal returns and its variance over the estimation window:

$$\begin{aligned} e_t &= r_t - \widehat{\alpha} - \widehat{\beta} r_t^M - \widehat{\theta} S_t \\ \widehat{\sigma}_e^2 &= \frac{1}{T-1} \sum_{t=t_0-k-T}^{t_0-k-1} e_t^2. \end{aligned} \tag{2}$$

[7] Underlying the validity of this approach are the assumptions that security markets are informationally efficient, that they form rational (unbiased) expectations, and that the "events" considered are exogenous with respect to the change in market value of the security. This last point is particularly relevant, and in our case it is likely to be satisfied, as UNITA attacks in the period under consideration mostly responded to internal political strategies vis-à-vis the official government than to the economic conditions of the mining firms operating in Angola.

[8] In what follows we shall mostly report results for the (-0,+1), (-3,+3) and (-5,+5) event windows, as a compromise between the uncertainty on the date in which the news spread, given the climate of instability in Angola, and the need to keep relatively short event windows. Results based on longer event windows are available from the authors.

We then calculate the abnormal returns in the event window using the estimated parameters $\widehat{\alpha}$, $\widehat{\beta}$, $\widehat{\theta}$ and the series $\{r_t^M\}$ over $t = t_0 - k, ..., t_0 + k$ and generate the series of the *cumulative abnormal returns* $\{CAR_t\}$ as

$$CAR_t = \sum_{j=t_0-k}^{t} e_j.$$

After performing the above analysis for each company in isolation, we aggregate the cumulative returns for the various companies by constructing two portfolios. The first one, which we call the "Angolan" portfolio, is constituted by diamond mining companies holding concessions in Angola. The second, which we refer to as "control" portfolio, is made of companies that do *not* have interests in Angola. We use the control portfolio to make sure that the effects we find for "Angolan" companies are not due to shocks in the market where they trade (and not captured by the market index $r_t^M$), nor to events affecting the diamond industry as a whole that may have occurred at the same time of an Angolan event.

The cumulative abnormal returns of the "Angolan" portfolio are:

$$\overline{CAR}_t = \frac{1}{n} \sum_{i=1}^{n} CAR_t^i \tag{3}$$

where $i = 1, ..., n$ refers to the individual "Angolan" companies. To assess whether a political event has any cumulative impact on the stock abnormal returns we plot the $CAR_t$ over the event window. A downward (upward) sloping $CAR$ indicates that the event had a negative (positive) impact on stock abnormal returns. We also provide a formal test of the null hypothesis that the event has no impact on the $CAR$ by exploiting the fact that, at least asymptotically, $CAR_{t_0+k}$ has a Normal distribution.[9]

The "control" portfolio is a weighted average of companies that do not have concessions in Angola (see below for the exact selection criteria), the weights being chosen endogenously so that the resulting portfolio represents a "good fit" of our Angolan portfolio before the event.[10] Denoting with $J$ the number of companies in the control portfolio, the excess returns of this portfolio are:

$$E_t^C = \sum_{j=1}^{J} w_j e_{j,t}^C$$

where the superscript $C$ stands for "control" and $e_{j,t}^C$ is the abnormal return of company $j$ at time $t$, calculated as in (2). The weights $\{w_j\}_{j=1}^J$ are chosen so that the control portfolio matches as closely as possible three natural properties of the Angolan portfolio: (i) the mean of abnormal returns; (ii) the variance of abnormal returns; and (iii) the OLS beta of a world market portfolio model that regresses daily control returns on the world market. A detailed description of our methodology is provided in Appendix A1. To summarize our procedure, we do the following. To adjust for the different scale of these three quantitative features, we employ two alternative weighting matrices $Q$. The first is a diagonal matrix containing the inverse of the standard deviations of the MLE estimators of the mean, the variance,

[9] For details on the test statistic, the reader is referred to Campbell et al. (1997), ch. 4.

[10] The "pre-event" period we employ to contruct our benchmark weights goes until January 31, 2002, i.e., three weeks before Savimbi's death.

and the market model beta. We refer to the weights found using this matrix as "variance weights." An alternative choice, similar to Abadie and Gardezabal (2003), consists of setting $Q$ to the diagonal matrix that allows the control portfolio to match as accurately as possible the monthly abnormal returns of the Angolan portfolio in the period that precedes the event under investigation. We refer to the resulting weights $w$ as "A-G weights". We show the results using as a benchmark the A-G weights and report the others as sensitivity analysis. To compare the control portfolio with the "Angolan" one, we inspect the trend of its $CAR$ and conduct hypothesis tests the same way as we do for the Angolan portfolio.

Finally, to compare the effects of different types of events on firm value, we perform an OLS regression on the full sample including as explanatory variables a set of event dummies that take value zero in days when nothing occurs and one when a given type of event occurs (see below for an operational definition). Formally, we calculate the abnormal returns $e_t^i$ for each of the $n$ "Angolan" companies from equation (2), and estimate the model

$$e_{i,t} = \kappa_i + \gamma D_t + \eta_{i,t}$$

where $\kappa_i$ is a company-specific constant term, $\gamma$ is a vector of coefficients, $D_t$ is the set of event dummies, and $\eta_{i,t}$ is the error term. We use the pooled sample, clustering the residuals at the company level. We perform a similar exercise on the pooled sample of companies belonging to our control portfolio, weighting the individual observations with the (square root of the) A-G weights $\{w_j\}_{j=1}^J$ described above, to take into account the different "importance" of non-Angolan companies.

### 3.2. *Data*

We conduct our analysis over the last phase of the conflict between UNITA and the MPLA government, namely the years 1998-2002. This is the period when UNITA resumed conducting violent attacks, until the death of its leader Jonas Savimbi and the cease-fire. In particular, our sample covers the days from January 1st, 1998 to June 28th, 2002. For this period we collected both financial data for diamond mining companies and indicators of political conflict. To construct our Angolan and control portfolios we proceeded in the following way.

**"Angolan" portfolio**

We started from the most comprehensive set of diamond mining companies holding concessions in Angola that we could assemble combining information from the Angolan Ministry of Mining and Geology, Cilliers and Dietrich (2000), and from Global Witness (1998). Considering that a large number of companies are not publicly traded, the final set for which we have price data over the entire sample period consists of seven companies. Their list, including the stock exchange where they are traded, is provided in Appendix A1. Our "Angolan" portfolio is an equally weighted average of these seven companies. We work with equally weighted returns because the companies under consideration have substantially different sizes and a more traditional value-weighted approach would essentially limit the analysis to De Beers, or to two or three additional companies at most. On the contrary, we are interested in detecting effects that are likely to have affected stock prices of all mining companies operating in Angola, presumably in

homogeneous directions. Nonetheless, given the atypical position of De Beers compared to other players, we also report results for the case in which De Beers is excluded from the Angolan portfolio.

**Control portfolio**

As explained above, our control portfolio is a weighted average of companies that do not have interests in Angola. More precisely, in order to be included in the control portfolio a company must satisfy all the following criteria:

(a) to be listed in one of the three markets where the "Angolan" companies are traded (i.e. Sydney, Johannesburg, and Toronto);

(b) to be continuously traded in our sample period;

(c) do not hold exploration or mining concessions in Angola during our sample period.

Criterion (a), i.e., using only companies listed on the same organized exchanges on which the "Angolan" companies are traded, is intended to lend plausibility to the assumption that one of the main differences between the abnormal daily returns of Angolan vs. control companies may indeed be related to political events in Angola. To this purpose, we estimate models of abnormal company returns that condition on the same underlying common factors, chiefly national stock market indices. Criterion (b) limits the analysis to a sample in which bankruptcy or listing events have no influence. As for criterion (c), it simply qualifies a company as belonging to the control sample. Starting from the universe of all diamond mining companies that satisfy criterion (a), the subset satisfying the remaining two is constituted by 42 companies. A complete list of these companies, including their weights in the portfolio, is provided in the Appendix table A1. The Appendix also provides a figure with the evolution of the abnormal returns of the two portfolios over the full sample period, to show that the tracking is quite satisfactory (see Appendix figure A1).

For all "Angolan" and "non-Angolan" companies we gathered daily, closing price information from Datastream and Bloomberg (taking the mean of the closing ask and bid prices), and calculated the implied daily return rates on the stock. We also collected the series of the market index for each market where the above companies were listed, and specifically: Sydney's AS30 for Australia, Toronto's TS300 for Canada, and Johannesburg All Share Index for South Africa. Additionally we collected returns on the MSCI total value-weighted World Index with the objective of estimating 'augmented' (multi-factor) market models in which abnormal returns are defined also with reference to the dynamics of the World market portfolio.[11]

### 3.3. *Firm value and the end of the conflict*

The natural starting point for our event study is the end of the conflict, as represented by Jonas Savimbi's death on February 22, 2002. While one can identify several other conflict episodes (e.g., particularly severe attacks by the government or by the rebels), on a-priori grounds it would be difficult to know whether a given episode was perceived as an increase or a decrease in the likelihood of conflict resolution. This would depend on the overall climate of tension and on the outcome of the attack. Also, even if we knew that an

[11] This index reflects the relative market capitalizations of the major national stock market indices, with US, Japanese, and UK markets taking up most of the total weight.

event increased the probability of conflict resolution, we could not know by how much. On the contrary, both the sign and the magnitude of the impact of Savimbi's death on the likelihood that the war would end is known with certainty. In fact, the rebel leader's death was unanimously perceived as the ending point of the conflict between the MPLA and UNITA. To quote one source out of hundreds, "[Savimbi's death] brings to an end UNITA's long military struggle with the Angolan government. The FAA have achieved an unequivocal military victory over UNITA."[12] This was because Savimbi's personality, with its military and political acumen and its ambition for power, was seen as the key obstacle to the peace process: "He embarked on a 27-year long quest for power which eventually took on the character of an obsession. (...) UNITA's military power was progressively weakened (...). For a brilliant tactician, there was no way out. The only option left was peace on the government's terms and a role for himself as a private citizen. It was not one he was prepared to consider".[13] Indeed, one and a half months after Savimbi's death, a formal cease-fire had already been signed putting an end to the Angolan conflict.

[Insert Figure 1]

Figure 1 contains our main result. It shows the evolution over time of the cumulative abnormal return (3) for the "Angolan" portfolio (left panel) and for the control portfolio (right panel) in the 10 trading days around Savimbi's death. The day of his death is indicated by a vertical line. Quite strikingly, for "Angolan" companies on average we do *not* observe an increase in cumulative abnormal returns, but rather a sizeable *decrease* leading to negative values. The hypothesis that $\overline{CAR}_t$ is zero in correspondence of the event is rejected against the alternative that it is negative at the 5 percent level for the (-3,+3) event window and at the 10 percent level for the (-0,+0), (-5,+5) and (-10, +10) windows. We have also experimented with shorter and asymmetric event windows such as (-0,+1), (-0,+3) and (-0,+5), and we always found a negative and significant impact.[14] To give an idea of the magnitude of our results, on February 22 our Angolan portfolio lost 4 percentage points, and five days after Savimbi's death it cumulative abnormal return had declined by 12 percentage points.[15]

When we turn to the control portfolio we instead find a *positive*, although insignificant, relationship between Savimbi's death and its $CAR$ built using A-G weights. The $CAR$ built with "variance" weights shows a less pronounced upward sloping trend, as shown in the left panel of Appendix figure A2.[16] Notice that if the negative effect on the Angolan portfolio were the result of an extraneous event affecting the diamond industry or the stock markets where the companies are traded, we should have observed a similar trend in the $CAR$ of the control portfolio, which is not the case. If we interpret the opposite sign in the trend of the $CAR$ of the control portfolio as the result of unobserved factors that (positively) affect the whole diamond industry, the magnitude of our effect actually increases: on the event date the difference

[12] Economist Intelligence Unit Country Report, May 2002, p.13.

[13] Ibidem, pp. 13-14.

[14] The $p$-value against the alternative of a negative $CAR$ ranged between .07 for the (-0,+1) event window and .06 for the (-0,+5) one.

[15] These figures are based on our estimates with the (-0,+0) and (-0,+5) event windows, respectively.

[16] For the (-3,+3) event window, the $p$-value against the alternative of a positive $CAR$ is .11 when we use A-G weights, and .42 when we use Variance weights.

between the $CAR$ of the "Angolan" portfolio and of its counterfactual is $-.07$.[17] Alternatively, the increase in the abnormal returns of the control portfolio may be caused by the Angolan event if investors switched out of "Angolan" stocks in favor of (similar) competing stocks. In either case, our main finding is that *investors perceived Savimbi's death as "bad news" for the companies holding mining concessions in Angola, and as "no news" or "good news" for otherwise similar companies not operating in the country.*

A possible interpretation of the above result is that Savimbi's death might have *increased* uncertainty over the end of the conflict, rather than decreasing it, for example because there was no clear successor to Jonas Savimbi and a "war in the war" for the succession could have developed. Although this interpretation is not in line with what the media and the public thought at the time, it is plausible on a priori grounds and we want to account for it.[18] For this reason we conduct a second event study corresponding to the "official" end of the war, namely, the signing of a cease-fire agreement between the FAA and UNITA on April 4, 2002. The effects of this other event are shown in figure 2.

[Insert Figure 2]

Again, the left panel shows that peace agreement has a negative and significant impact on cumulative abnormal returns for the "Angolan" portfolio: the null is rejected against the alternative of a negative $CAR$ with a p-value of .03 for the (-0,+0) and (-3,+3) event windows. On the day of the cease-fire, the abnormal return on this portfolio was $-.04$. If we take March 30 – the day in which the cease-fire memorandum was presented – as the starting date of our event window, the cumulative abnormal return on April 4 was $-.09$. On the contrary, the control portfolio displays a weakly positive but insignificant reaction to the signing of the cease-fire, as shown in the right panel of figure 2.[19] We can therefore conclude that the *unambiguous* end of the war is still bad news for diamond mining companies working in Angola.[20]

Notice that our results do not depend on the choice of the underlying model for normal returns. As shown in Appendix A2, when we estimate abnormal returns from a multi-factor, international CAPM-style

[17] This figure is based on our estimates with the (-0,+0) event windows. If we employ the (-5,+5) event window used for the graphs, the difference is even larger.

[18] The fact that after Savimbi's death UNITA leaders would have sought a compromise with the government rather than continue to fight was considered extremely likely also in the light of the numerous defections that had occurred within UNITA ranks in the years 2000 and 2001, when prominent members had founded the party "UNITA Renovada" and entered the government coalition.

[19] The p-values against the alternative of a positive $CAR$ never go below .25. As before, figure 2 displays the $CAR$ of the control portoflio built using A-G weights, and the analogous with variance weights is reported in Appendix figure A2 (right panel). The difference between the $CAR$ of the Angolan and of the control portfolio on the day of the cease-fire was $-.04$.

[20] Before turning to potential explanations for our finding, it is worth noticing that the trends in figures 1 and 2 suggest that both events may to a certain extent have been anticipated by investors. This is not as surprising as it may seem. In fact, a few days before February 22, two prominent figures of UNITA had been killed by the FAA, namely Almeida Ezequiel Chiccende (deputy chief of staff) and General Galiano da Silva e Sousa (national political commissioner). Furthermore, the strategy adopted by the FAA in late 2001 to push civilians away from the countryside in order to deprive UNITA's fighters of food supplies had been quite succesful. Senior officials of the rebel movement, including the vice-president Antonio Dembo, were said to be starving and short of medical supplies. The second event, i.e., the ceasefire of April 4, was not difficult to predict. On March 13 the government had announced its intention to suspend offensive operations and begin peace talks with UNITA's leadership. A ceasefire memorandum had been signed on March 30 and the formal ceasefire four days later sanctioned the end of the war.

model instead of a simple market model, our results are basically unchanged.

### 3.4. *Can war be good for incumbent companies?*

How can we explain the apparently paradoxical reaction of investors to the end of the conflict? Our interpretation is that the positive effects of the resolution of uncertainty were counterbalanced by the expectation that the newly acquired stability of the government would shrink the profit margins of the companies already holding concessions. This could occur for at least three reasons.

The first, and most obvious, one is an increase in the *competition* faced by incumbent diamond mining firms due to the potential entry of new firms. The presence of a civil war, especially so harsh as the one in Angola, limits participation in the mining sector to a certain type of firms, i.e., firms that can work in high risk environments. This involves a number of aspects, among which the willingness/ability to contract private security firms and/or strike deals with local armed forces, as well as the sheer economic potential to sustain increased production costs due to the fact that road transportation becomes insecure and supplies may have to be brought in by air.[21] One could therefore conceive that after the end of the war many more firms could afford or be willing to enter the Angolan mining sector, and this would limit the prospects for incumbents in acquiring new concessions. Industry sources, however, suggest that the threat of rotential entry of new firms was not perceived as particularly serious in our case. Indeed, between February 2002 and today, most incumbents reinforced, if anything, their position in the Angolan mining sector.[22] As a matter of fact, the largest player in the market was and remains an Israeli diamantaire Lev Leviev, who already in 2000 had acquired the right to market the entire Angolan production through Ascorp (see section 2).

A second channel through which peace might have damaged mining firms is the effect on *diamond prices*. Immediately after the cease-fire, a spokesman of Ascorp gave an eloquent comment in this sense: "This cease-fire in Angola is potentially a great threat to the likes of De Beers because what it means is that Angola now has the opportunity to produce more diamonds and flood the international market and reduce prices. These big companies are naturally threatened by peace in Angola, ironic though that may be."[23] We can rule out this explanation on three grounds. The first is that, being a generalized (world wide) effect on diamond prices, this should have affected firms in our control portfolio the same way as firms in our Angolan portfolio, and this was not the case. The second is that, at least so far, diamond prices have not responded to the changed situation in Angola. Figure 3 shows the evolution of the price of gem quality diamonds between April 24, 1998 and March 21, 2003 at the highest frequency available,

[21] It is estimated that during our sample period average security costs for a mine were approximately $500,000 a month (Angola Peace Monitor, 31 January 2001, p.4).

[22] During 2002, Endiama established a joint venture with SouthernEra (in our portfolio) and the Israeli-owned Welox to develop the Camafuca kimberlite pipe, for which SouthernEra had already completed a feasibility study by 2001. As for later years, according to a Mining Annual Review 2004 article by Paul Crankshaw, not yet published, the three projects in which new production was to be expected were in Fucauma-Luarica, Alto Cuilo, and on the Chicapa River. The foreign partners in these projects were, respectively: TransHex, Petra Diamonds, and Alrosa, and all three were already present in Angola throughout our sample period. TransHex belongs to our Angolan portfolio; Petra Diamonds was delisted for one year during our sample period; and Alrosa is owned by the Russian government.

[23] Source: Mazal U'Bracha Magazine, April 2002, reported by www.diamondsview.com.

i.e. weekly. The price reported (in hundreds of US dollars) is the price per carat asked by professional dealers for the best quality round diamonds available on the market.[24] As is well known, diamond prices move very little due to the cartel nature of the industry, with prices being fixed for several months in a row. In particular, the thirteen months after Savimbi's death do not show any change in prices.

[Insert figure 3]

Finally, the company who" was threatened the most by the potential price effect was De Beers. However, when we exclude De Beers from the Angolan portfolio, the results remain virtually unchanged. Figure 4 reports the effects of Savimbi's death on the $CAR$ of this "reduced" Angolan portfolio (left panel), and on a control portfolio constructed to track this reduced portfolio in the pre-event period (i.e., with different weights compared to the control portfolios of figures 1 and 2). The only difference with respect to figure 1 is a slight increase in the size of the effect.

[Insert figure 4]

The third explanation, and the one we find more compelling for the Angolan case, has to do with the behavior of the government and the way in which mining concessions were awarded in the country. For lack of a better term, we shall refer to this as the "*rent seeking*" explanation. The concession of mining rights has traditionally been one of the chief forms of patronage for the Angolan government. Among others, Hodges (2004) denounces that diamond concessions "have become one of the new nomenklatura's main avenues for accumulating wealth, while the shadowy procedures for awarding the concessions provide another prime example of the non-transparency of resource management and the role of presidential patronage in building and cementing alliances."[25] Aside from the lack of transparency on the awarding process, which in more than one" case favoured relatively weaker bidders against major foreign companies, two ways in which government officials extracted rents from this process were the partnership with local mining firms and the contracting of private security companies. As described in section 2, according to the 1994 mining law all mineral rights were vested in the state company Endiama, but foreign companies could form joint ventures with Endiama by involving an Angolan partner. Local companies owned by well connected officials and elite members took advantage of this provision to seek partnerships in which they provided almost nothing except access to government favoritism.[26] Many FAA generals, on the other hand, also benefited from the situation by forming private security firms that were contracted by the mining company being awarded the concession, sometimes as an implicit part of the deal.

[24] Technically, these are "internally flawless" (IF clarity) diamonds, D color, to approximate the best stones produced in Angola. The pattern is basically identical if slightly inferior clarity (VVS1 or VVS2) or different carat sizes (.23-.29 or 1.00-1.49) are used. This is the data underlying the main source used by professionals in the industry, namely, the Rapaport Diamond Report. We thank Martin Rapaport for giving us access to this data.

[25] Hodges (2004), p.190.

[26] Hodges (2004) cites the example of one contract under which "the foreign partner is responsible for all mining activities and, after deduction of costs and fiscal obligations, shares the rest of the production with the Angolan concessionaires on a 50-50 basis" (ibidem, p.193).

An alternative to this complex web of alliances was for some miners to buy protection directly from UNITA. During some phases of the conflict, e.g., right after the Lusaka Protocol, this was legal in the sense that the UNITA company Sociedade Geral Mineiro (SGM) had legal mining rights and could form partnerships with foreign mining companies. In the last phase of the conflict, this became an underground measure as mining by UNITA had been declared illegal. As late as October 2001, the expert panel of the UN Monitoring Mechanism was writing that "many of the diamond companies have a previous history of working with UNITA and the Mechanism has information that some companies continue to do so. However, direct proof of working with UNITA is extremely difficult to find."[27] A recent analysis of the Angolan diamond industry suggests that working under UNITA protection could be a particularly cheap way to extract diamonds in certain areas: "according to one former garimpeiro who worked in the twilight zone between UNITA and government control, foreign dealers paid $250 to"UNITA for prospecting rights."[28]

Our conjecture is that during the war *the threat constituted by UNITA posed a limit to the monopoly power of the government* over mining rights, and this moderated the extent of exploitation that the latter could impose on foreign mining companies. At the end of the war, on the other hand, there was a decrease in the number of players who could provide protection, and an increase in expected payments to the state monopoly. In a sense, this can be viewed as a "competition" story on the supply side rather than on the demand side of mining concessions. Once the "competitive force" of armed conflict disappeared, the management of the diamond industry became more centralized and fears of increased rent extraction likely prevailed in the mind of investors over relief for the end of the war. An explicit quote in this sense comes from the Economist Intelligence Unit in the immediate aftermath of the cease-fire: "The end of the war will undoubtedly open up new areas to exploitation by foreign and Angolan mining companies. However, most foreign companies are wary of conditions in Angola following years of contract-breaking by the Angolan authorities."[29] A synthetic quote from a local source is possibly more explicit:

> "The end of the war in Angola means that right now the main institution in the country is corruption."[30]

Note that this explanation does not require the rebel movement to be less rent seeking than the official government, although in the case of Angola it can be argued that investors indeed perceived UNITA as more friendly towards foreign investors than the MPLA, possibly because of the Marxist-Stalinist origin of the government party.[31] All that is needed is that civil war creates an environment in which neither party

[27] UN Monitoring Mechanism report, October 2001, § 186. The same expert panel in its first report, dated March 2000, wrote: "Before the imposition of diamond related sanctions by the Council, mining permits had also been auctioned off to foreign companies for the exploitation of mines within UNITA controlled territory, but it is unclear whether or to what extent this activity might still be occurring." (§ 79).

[28] Pearce (2004), p.4.

[29] Economist Intelligence Unit, Country Report, May 2002, p.27.

[30] Quote by Rafael Marques, a dissident journalist from Luanda. Reported by Tim Butcher in "As guerrilla war ends, corruption now bleeds Angola to death", www.telegraph.co.uk, 30 July 2002.

[31] In 2000 and 2001 Political Risk Services reported that "(...) business would have little to fear from a UNITA government. Most of UNITA's leaders are receptive to foreign private investment. Savimbi himself has acknowledged that Angola needs international input (...). The party has promised that once in power, it would honor existing contracts that were fairly negotiated." (Source: *Angola Update*, 1 August 2000 through 1 January 2002).

can fully monopolize the management of natural resources, which limits the scope for rent extraction from private businesses. In the remainder of this section we offer suggestive empirical evidence to corroborate this hypothesis. We then turn to the relationship between different types of conflict-related events and firms' value.

[Insert Figure 5]

That the management of government licenses was not perceived as particularly beneficial to foreign diamond companies can be seen by looking at an earlier event: the unexpected suspension by the vice-minister of geology and mines of Endiama's managing director, Jose Dias, on allegations of corruption on January 26, 1999. Figure 5 reports the $CAR$ for our "Angolan" and control portfolio in correspondence of this event. Angolan stocks show a significant increase in their abnormal returns following the suspension of the corrupt director, while the same does not hold for stocks in our control portfolio. The null of a zero $CAR$ for the Angolan portfolio is rejected against the alternative of positive $CAR$ at the 1 percent level for the (-3,+3 event window). The corresponding p-value for the control portfolio is .29. In other words, this anti-corruption episode was perceived as good news for the mining companies directly interested by it, but not for other companies.

### 3.5. *How different types of events affect firm value*

In this section we conduct a more systematic event analysis to contrast the effect of the "end of the war" with other conflict-related events, such as UNITA attacks on civilians, attacks on mines, government victories, etc. We also include episodes of tightening in industry regulation to corroborate our hypothesis on investors' perceptions of government interventions. To select the relevant events, we performed a Lexis-Nexis search and complemented it with web sources specifically focused on Angola (see the next section for a detailed definition of the criteria). On the basis of the number of casualties and/or of the relevance given to each episode by the media, we selected 19 events that we grouped under six categories:

(a) end of conflict: events related to the unambiguous end of the civil war;

(b) government victories over UNITA: key military successes of the FAA over the rebels during the course of the war;

(c) UNITA attacks on civilians: key episodes of killings of civilians by UNITA forces;

(d) UNITA attacks on industrial diamond mines: attacks specifically targeted to industrial mines;

(e) UNITA attacks on garimpeiros: attacks on diamonds fields in which artisanal miners were killed;

(f) industry regulation: key episodes of increased government control on the diamond sector.

A comprehensive list of individual events is reported in table 1.

[Insert tables 1, 2]

We then regressed the daily abnormal returns of our "Angolan" and control companies on company fixed effects and on six dummies corresponding to the above categories of events.[32] The results are reported

[32] For example, the dummy "end of conflict" takes value one on 2/22/2002 and on 4/4/2002, and zero on all other dates.

in table 2. Looking at column 1, the first and most notable result is that, in correspondence with the "end of the conflict", the abnormal returns of "Angolan" companies decreased by 3.2 percentage points, and this effect was statistically significant at the 5 percent level. This estimate is fairly close to the 4 percentage points decrease that we obtained in our event study (section 3.3), the difference being due to the fact that the residual $e_{i,t}$ was estimated on the full sample here, and on a shorter pre-event window before. For the companies in our control portfolio, the end of the conflict has either an insignificant or a positive effect, depending on the set of weights that we use.

When we turn to attacks and military victories that occurred during the course of the conflict we do not find any significant relationships. The dummy "Government victories" refers to news about major UNITA defeats in the sense of strategic sites and strongholds being officially handed over to government forces. The dummy "UNITA attacks civilians" refers to shellings of cities in which hundrends of civilians died and to deliberate attacks on non-military targets, which the rebel group employed to gain territory as well as to divert the FAA operations away from its own bases. Neither variable has a significant impact on the abnormal returns of "Angolan" or of "control" stocks, possibly because the protracted nature of these episodes is not well captured by one-day dummies, or because over the course of four years there were so many of these episodes that identifying the most salient ones is not an uncontroversial task. To this extent, the analysis using a continuous tension variable that we propose in the next section is likely to yield more meaningful results.

UNITA attacks on industrial mines have instead a negative and significant impact on the value of "Angolan" companies. On the days in which the rebels attacked the mines of two of the companies in our sample, the abnormal return of our "Angolan" stocks declined on average by 3.4 percentage points. These attacks forced the temporary closure of the mines involved, and constituted a potential threat to other industrial mining operations in the country. The corresponding effect on the stocks of our control portfolio was positive, either because of unobserved events affecting the whole diamond"industry, or due to the resulting competitive advantage of "non-Angolan" companies. In a portfolio perspective, the difference in signs of the (significant) coefficients associated with UNITA attacks matches a logic by which rational investors switch out of Angolan stocks that have become rebel targets in favor of similar non-Angolan companies that operate in more stable environments. This is also consistent with the fact that attacks on unorganized artisanal miners (*garimpeiros*) had no impact on either group of mining companies.

Finally, the dummy "Industry regulation" identifies episodes in which the Angolan government tightened its control on the diamond sector by centralizing the marketing process and imposing stricter regulation on joint ventures. We can see from column 1 that these interventions had a negative and significant impact on the abnormal returns of our "Angolan" companies, and no effect on those belonging to the control portfolio. This corroborates our interpretation that investors did not perceive the management of the diamond industry by the Angolan government as particularly favorable to foreign companies holding concessions in the country.

## 4. **Conflict and stock market reactions: nonparametric regressions**

The goal of this section is to assess the impact of a varying *intensity* of conflict on stock market reactions. Having shown that specific conflict-related events (e.g., Savimbi's death, the cease-fire, etc.) had a significant impact on the value of mining companies holding concessions in Angola, is it possible to find a relationship between stock returns and a continuous measure of political tension? For this purpose, we employ conflict variables that contain daily information on several aspects of the conflict, and estimate their relationship to stock abnormal returns over the entire sample period. We start by specifying a possible nonlinear relationship predicted by the theory, and then estimate it using nonparametric techniques.

### 4.1. *Methodology*

Consider a setting in which there is an ongoing conflict between the incumbent government ($g$) and a rebel group ($r$). Suppose that political tension is measured by a continuous variable $\tau \geq 0$, with $\tau = 0$ indicating that the government is uncontested and with increases in $\tau$ corresponding to increases in the probability that the rebel group gains control. The variable $\tau$ can be thought of as military attacks or occupations of portions of the territory by the rebels. Denoting with $\lambda_g \in [0, 1]$ the probability that the government is the ultimate winner of the conflict and with $\lambda_r \in [0, 1]$ the probability that the rebels prevail, it is natural to assume that $\lambda_g$ and $\lambda_r$ are a decreasing and an increasing function of $\tau$, respectively. As a consequence, the overall probability of conflict resolution $\lambda \equiv (\lambda_g + \lambda_r) \in [0, 1]$ is a non-monotonic function of our continuous measure of tension $\tau$, as illustrated in figure 6.[33]

[Insert figure 6]

Once we know the relationship between political tension $\tau$ and the probability of conflict resolution $\lambda$, we can infer the relationship between $\tau$ and firm value. If the end of the conflict is good news for companies operating in the country, then we expect the relationship between $\tau$ and the companies' abnormal returns to be U-shaped as well. If, on the contrary, the conflict is beneficial to these firms, then we expect to see an inverted-U relationship.

In what follows we estimate the relationship between a stock abnormal returns $e_t$ and the continuous tension variable $\tau_t$, using a local polynomial regression of the fifth order. We choose to rely on nonparametric methods in order to avoid committing to specific (and possibly misspecified) non-linear functional forms.[34] Following the previous event analysis, the abnormal returns $e_t$ are estimated as the residuals of an augmented market model, i.e., as in equation (2). Individual companies' abnormal returns are then

[33] Sufficient conditions for the relationship between $\tau$ and $\lambda$ to be smooth and convex as in the figure is that the underlying functions satisfy the following assumptions:

(A1) $\lambda_g'(\tau) < 0$, $\lambda_g''(\tau) \geq 0$, $\lambda_g(0) = 1$, $\lim_{\tau \to \infty} \lambda_g(\tau) = 0$ , and

(A2) $\lambda_r'(\tau) > 0$, $\lambda_r''(\tau) \leq 0$, $\lambda_r(0) = 0$, $\lim_{\tau \to \infty} \lambda_r(\tau) = 1$.

[34] In our application, for all values of the regressor $\tau_t$ we use the entire sample but attach declining weights to observations more distant from $\tau_t$, using a tri-cubic scheme. We set the polynomial order to 5 because this value is high enough to accommodate complex linear shapes but still limits the number of parameters to be estimated for each selected neighborhood, and therefore the computational burden. Results remain essentially unchanged for higher order polynomials, although some increasing jaggedness of the regression function appears. We make the neighborhood symmetric around $\tau_t$ to avoid overfitting

aggregated to form an Angolan and a control portfolio exactly as in the previous sections. The analysis is performed at the aggregate, portfolio level as currently available non-parametric methods do not allow us effective pooling strategies that account for clustering in residuals and/or fixed effects. Before turning to the results, we explain how our tension variable is constructed.

### 4.2. *Indicators of political tension*

Information on political events in Angola was obtained through a variety of sources. We performed a search on the Lexis-Nexis database in the category 'World News' from the news source 'Middle-East and Africa', using the following keywords: UNITA, FAA, Savimbi, rebels, and diamond(s). We also did a focused search on the same database including the term Angola together with (alternatively): deaths, dead, killed, wounded, injured, attack(s), victims, strike(s). For each piece of news we recorded the number of times it was reported by different agencies. The total number of hits was 23,207 (some of which turned out to be unrelated with our search). We also complemented Lexis-Nexis with several additional web sources.[35] Events were registered on the first day in which they were reported by any type of media. This may not coincide with the day in which they actually (or supposedly) happened, but it seems the most reliable way of setting the date at which investors may have come to know about them.[36] We then coded this information into daily figures for the following variables:

- *civdeath*: number of civilians dead;
- *civwound*: number of civilians wounded;
- *mildeath*: number of military deaths;
- *milsup*: number of military officials (superior grade) dead;
- *attacks*: number of attacks;
- *agencies*: number of press agencies reporting the news.

This last variable is meant to capture the perceptions of the media on how serious a given episode is. The other variables have been aggregated into a single political tension index through principal components analysis. In particular, in what follows we shall employ two tension indexes: *TensionPC* (the first principal component extracted from *civdeath, civwound, mildeath, milsup,* and *attacks*) and *Agencies*.[37] Figure 7 reports the evolution over our sample period of these two indexes. As can be seen from the figure, they both reveal a high prevalence (and also a high variability) of tension.

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at the edges of the sample, where the data are denser. Additionally, we perform four rounds of supplementary robustness iterations: the local regressions are iterated after adjusting the neighborhoods to downweight outlier observations (using bi-square weights). Appendix A.2 gives technical details.

[35] Among the most frequently used were the Angola Peace Monitor by Action for Southern Africa (http://www.actsa.org/Angola/apm/), the Integrated Regional Information Networks Africa (http://www.irinnews.org), the UN Office for the Coordination of Humanitarian Affairs (http://www.reliefweb.int), and War News (http://www.warnews.it/ita/angola.html).

[36] In a few instances in which the announcement is one of UNITA's periodical accounts of its activities over a long period, and the figures on casualties seemed to have been grossly inflated, such figures have been ignored.

[37] The eigenvectors on the above five variables for the first principal component are, in the order: 0.48, 0.59, 0.24, 0.16, and 0.58. We also extracted principal components from the full set of variables (including the number of agencies), but in what follows prefer to keep the 'factual' and the 'perception' dimensions separate.

[Insert Figure 7]

### 4.3. *Results*

The main results of our nonparametric estimates are presented in figure 8.

[Insert Figure 8]

Figure 8 plots the actual and fitted abnormal returns of our Angolan portfolio (top panel) and control portfolio (bottom panel) against the index *TensionPC*. The dashed lines around the fitted returns indicate the 10 percent confidence interval.[38] The relationship for the Angolan portfolio has approximately an inverted-U shape. The first interval in which abnormal returns seem to decrease as tension increases is largely the result of the censoring of our tension variable at its minimum (i.e., days in which the press recorded no events). In fact, when we look at the confidence bands, it is clear that in this first interval there is no statistically significant relationship. On the contrary, the inverted-U shape is statistically significant at the 10 percent level. This suggests that intermediate levels of tension are good news for Angolan firms, while extremely low and extremely high levels are bad news. If we recall the mapping between tension and the probability of conflict resolution shown in figure 6, this pattern is consistent with our earlier result that the end of the war was bad news for firms. In this case the end of the war would be represented by relatively low (government victory) and relatively high (UNITA victory) values of $\tau$. Notice that the negative relationship between violence and abnormal returns at high levels of $\tau$ could also be explained by the sheer damage to infrastructure and increased production costs caused by an intense war. However, on these grounds it would be difficult to explain the positively sloped part of the relationship, i.e. why abnormal returns increase with tension at moderate levels of violence. We therefore believe that, even if it may not be the sole explanation, the interpretation we proposed in section 3.4 is very plausible also for this result.

To make sure that the estimated relationship is not spurious, we repeated the same exercise on the control portfolio of "non-Angolan" companies built with A-G weights. The result is reproduced in the bottom of figure 8, and clearly shows that there is no relationship between tension in Angola and the abnormal returns of our control portfolio. When we use "variance" weights to build the control portfolio, the results are very similar, as shown in Appendix figure A5.

[Insert Figure 9]

Figure 9 shows the results of our nonparametric regressions when the tension indicator is the number of press agencies reporting a given event. Broadly speaking, the pattern is similar to that of figure 8, although the bell shaped relationship for the Angolan portfolio is less pronounced. This is not surprising, as the variable *Agencies* picks up not only the relevance given by the press to conflict-related news, but also other news in which any of our keywords appear. Considering the noise in this indicator of tension,

[38] The confidence intervals are obtained by bootstrapping. We perform 500 simulations and calculate the interval by leaving 25 simulations above and 25 below.

it is already surprising that the results bear such resemblance with those obtained with the principal component variable. On the other hand, no statistically significant relationship emerges for the control portfolio using A-G weights, and the same holds with the other set of weights (see Appendix figure A5, panel b).

Overall, the results in this section suggest that the relationship between the intensity of conflict (as proxied by variables such as rebel attacks, civilian and military deaths, civilians wounded, and press coverage) and the abnormal returns of diamond mining companies operating in such conflict environment is non-monotonic. In particular, at low levels of conflict, increases in rebel attacks and casualties seem to *increase* rather than decrease firm value. After a given threshold, further increases in conflict have the negative effect that most of the existing literature suggests. No pattern at all emerges for diamond mining companies in our control group, i.e., not holding concessions in Angola. We take this result to be consistent with our earlier finding that the end of the war was perceived as "bad news" by investors, and propose a similar explanation for why moderate levels of conflict may have been beneficial to mining firms in the Angolan context.

## 5. **Concluding remarks**

This paper has examined the relationship between civil war and the value of firms in a poor, resource abundant economy. We focus on the diamond sector in Angola and estimate stock returns for a sample of diamond mining companies holding concessions in the country, and for a control portfolio of otherwise similar companies not operating in Angola. Using an event study approach, we find that the end of the conflict, as represented by the death of the rebel leader and by the official cease-fire, *decreased* instead of increasing the abnormal returns of the "Angolan" portfolio. This effect is sizeable and statistically significant, and is not likely to arise from unmeasured shocks to the diamond industry occurring at the same time, as the "counterfactual" constituted by our control portfolio shows no significant (or even a weakly positive) reaction. This results is corroborated by a complementary analysis in which we employ nonparametric techniques and estimate the relationship between company abnormal returns and the *intensity* of conflict, using daily data on war related violence in Angola. We find an inverted-U relationship for the "Angolan" portfolio, suggesting that at low levels of conflict moderate increases in tension are preceived as beneficial by investors, but after a given threshold further violence becomes detrimental. We interpret our results in the light of the regulatory constraints faced by foreign firms and of the rent seeking environment common in resource dependent economies such as the Angolan one. The occupation of parts of the territory by the rebels and the instability created by civil war may limit the government's ability to extract rents as well as the threat of entry of new firms, and thus be (to some extent) beneficial for incumbent companies. In this sense, our results should not be viewed as in contrast with previous studies that found a negative effect of conflict on investment, but rather as an attempt to call attention on the relationship between conflict and political economy aspects that we believe are very relevant for developing countries.

## References


[1] Abadie, A. and J. Gardeazabal (2003), "The Economic Costs of Conflict: A Case-Control Study for the Basque Country," *American Economic Review*, 93(1), 113-133.

[2] Alesina, A. and R. Perotti (1996), "Income Distribution, Political Instability and Investment", *European Economic Review*, 40, 1203-28.

[3] Campbell, J., A., Lo, and C., MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton University Press.

[4] Cilliers, J. and C. Dietrich, eds., (2000), *Angola's War Economy. The Role of Oil and Diamonds*, Pretoria: Institute for Security Studies.

[5] Collier, P. and A. Hoeffler (1998), "On the Economic Causes of Civil War", *Oxford Economic Papers*, 50, 563-573.

[6] Fan, J. and I., Gijbels (1996), *Local Polynomial Modelling and Its Applications*, Chapman & Hall.

[7] Fisman, R. (2001), "Estimating the Value of Political Connections", *American Economic Review*, 91, 1095-1102.

[8] Global Witness (1998), *A Rough Trade. The Role of Diamond Companies and Governments in the Angolan Conflict.* Global Witness Report, London.

[9] Hodges, T. (2004), *Angola: Anatomy of an Oil State*, Bloomington: Indiana University Press.

[10] Johnson, S. and T. Mitton (2003), "Cronyism and Capital Controls: Evidence from Malaysia," *Journal of Financial Economics*, 67(2), 351-382.

[11] Le Billon, P. (2000), "Angola's Political Economy of War: The role of Oil and Diamonds 1975-2000", *African Affairs,* 100, 55-80.

[12] Pearce, J. (2004), "War, peace and diamonds in Angola: Popular perceptions of the diamond industry in the Lundas," Situation Report, Pretoria: Institute for Security Studies.

[13] Roberts, B.E. (1990), "A Dead Senator Tells No Lies: Seniority and the Distribution of Federal Benefits", *American Journal of Political Science*, 34(1), 31-58.

[14] Ross, M. (2004), "What Do We Know About Natural Resources and Civil War?", *Journal of Peace Research*, 41(3), 337-356.

[15] Svensson, J. (1998), "Investment, Property Rights and Political Instability: Theory and Evidence", *European Economic Review*, 42, 1317-41.

# Appendix

## A1. "Angolan" and control portfolio

Our "Angolan" portfolio is an equally weighted average of the following seven stocks:[39]

1. American Mineral Fields Inc., Toronto Stock Exchange (TSX)
2. Ashton Mining Ltd., Australian Stock Exchange (ASX)
3. Caledonia Mining Corporation, TSX
4. De Beers Consolidated Mines Ltd, Johannesburg Stock Exchange (JSE)
5. Diamondworks Ltd., TSX
6. SouthernEra Resources Ltd., TSX
7. Trans Hex Group Ltd., JSE.

To build the control portfolio, we proceed as follows. We start with the Angolan portfolio, whose excess returns are modeled by the process $E_t = n^{-1}\sum_{i=1}^{n} e_{i,t}$, $n$ being the number of "Angolan" companies, and we are interested in building a control portfolio constituted by diamond mining companies that do not hold concessions in Angola. The objective is to find a vector of weights $\mathbf{w} \equiv \{w_1, ..., w_J\}$ to be assigned to stocks in the control portfolio, where $J$ is the number of companies not operating in Angola for which data are available. The excess returns of this "Non-Angolan" portfolio"are thus:

$$E_t^C = \sum_{j=1}^{J} w e_{j,t}^C,$$

where the superscript $C$ stands for "Control."

In order for the control portfolio to constitute a meaningful benchmark, we chose $\mathbf{w}$ so that in the pre-event period the control portfolio matches as closely as possible three natural properties of the Angolan portfolio: (i) the mean of abnormal returns; (ii) the variance of abnormal returns; and (iii) a market model beta employing returns on the world market portfolio as a regressor. Specifically, we select $\mathbf{w}$ to minimize the Euclidean distance between the vector $\mathbf{v}$ collecting the three features of our Angolan portfolio and a vector $V^C\mathbf{w}$ collecting the same features for the control portfolio, where $V^C$ is a $3 \times J$ matrix that collects the same features for each of the $J$ non-Angolan companies:

$$\min_{\mathbf{w}} (\mathbf{v} - V^C\mathbf{w})' Q (\mathbf{v} - V^C\mathbf{w})$$
$$s.t.\ \mathbf{w}'\mathbf{1}_J = 1 \quad \mathbf{w} \geq \mathbf{0}.$$

The constraints in the above problem require that weights are nonnegative and sum up to one; $Q$ is a weighting matrix that adjusts for the different scale of the quantitative features under consideration.

[39] Two of the seven companies changed denomination during our sample period. (1) On January 17, 2001, Ashton Mining Ltd. Canada was absorbed as a wholly owned subsidiary of Rio Tinto Plc., also"listed in the ASX. We include a dummy for this date in our augmented market model and use the Rio Tinto series afterwards. (2) On June 1, 2001, De Beers Consolidated Mines Ltd. and a sister company De Beers Centenary were taken private DE BEERS SA, a holding company owned by South Africa's Anglo American and the Oppenheimer family (45% each). We include a dummy for this date in our augmented market model and use the Anglo American series afterwards.

In particular, let $\mathbf{v}$ be defined as:

$$\begin{aligned}
\mathbf{v} &\equiv [\hat{\mu}_E \ \hat{\sigma}_E^2 \ \hat{\beta}_E]' \\
\hat{\mu}_E &= T^{-1}\sum_{t=1}^{T} E_t \\
\hat{\sigma}_E^2 &= T^{-1}\sum_{t=1}^{T}(E_t - \hat{\mu}_E)^2 \\
\hat{\beta}_E^W &= \frac{T^{-1}\sum_{t=1}^{T}(E_t - \hat{\mu}_E)(R_t^W - T^{-1}\sum_{t=1}^{T} R_t^W)}{T^{-1}\sum_{t=1}^{T}(R_t^W - T^{-1}\sum_{t=1}^{T} R_t^W)^2}.
\end{aligned}$$

Clearly, $\hat{\mu}_E$ and $\hat{\sigma}_E^2$ are simply sample estimators of the mean and the variance of abnormal returns, while $\hat{\beta}_E$ represents the sample estimator of a market model beta employing returns on the world market portfolio as a regressor, $E_t = \alpha + \hat{\beta}_E^W R_t^W + \eta_t$, with $\eta_t$ standard white noise disturbance. Since it is clear that means, variances and betas are measured in different units, a natural candidate weighting matrix in this case is:

$$Q_1 \equiv \begin{bmatrix} \sqrt{T}/\hat{\sigma}_E & 0 & 0 \\ 0 & T/\hat{\sigma}_E & 0 \\ 0 & 0 & \sqrt{T}\hat{\sigma}_W/\hat{\sigma}_E \end{bmatrix}.$$

The reader will easily recognized the inverse of the (asymptotic) standard deviations of the MLE estimators of the mean, the variance, and the market model beta, respectively. We refer to these weights as "Variance weights".

An alternative choice, similar to Abadie and Gardezabal (2003), consists of setting $Q_2$ to the diagonal matrix that allows the control portfolio to best reproduce any of the quantitative features under consideration. In particular, we shall care of using a target portfolio that matches as accurately as possible the *monthly* mean abnormal returns characterizing the target, Angolan portfolio, i.e.

$$\hat{\mathbf{m}}_E \equiv \left[E_1,\ 1/2\sum_{t=1}^{2} E_t,\ 1/3\sum_{t=1}^{3} E_t,\ \ldots\ ,\ 1/T\sum_{t=1}^{T} E_t\right]'.$$

In this case $Q_2$ will be the diagonal, positive definite (i.e. with positive diagonal elements only) matrix that solves:

$$\min_{Q_2}(\mathbf{m}_E - M\mathbf{w}(Q_2))'(\mathbf{m}_E - M\mathbf{w}(Q_2))$$

where

$$M = \begin{bmatrix} e_{1,1}^C & e_{2,1}^C & \cdots & e_{J,1}^C \\ e_{1,2}^C & e_{2,2}^C & \cdots & e_{J,2}^C \\ e_{1,3}^C & e_{2,3}^C & \cdots & e_{J,3}^C \\ \vdots & \vdots & \ddots & \vdots \\ e_{1,T}^C & e_{2,T}^C & \cdots & e_{J,T}^C \end{bmatrix},$$

i.e. a matrix that collects in each of its columns the vector of daily abnormal returns for each of the $J$ control stocks. The notation makes it explicit that $\mathbf{w}$ effectively depends on $Q_2$ through the optimization problem. The sense of this choice of the weighting matrix $Q_2$ is that we would like the control portfolio to give mean abnormal returns of the same magnitude as the target portfolio. We denote the resulting weights as "A-G weights".

The pre-event sample period we used for the weighting was from January 1, 1998 to Jan. 31, 2002. We computed both sets of weights for an Angolan portfolio that included De Beers and for one that did not. The results are displayed in Appendix Table A1. Appendix figure A1 shows how our controls portfolio tracks the Angolan one over the sample (pre and post-event) period, using both sets of weights.

[Insert Appendix Table A1 and Figure A1]

## A2. Multi-factor model

As an alternative to the market model (1), we estimated the abnormal returns of each stock from a multi-factor model that included a world market index among the regressors. The idea is that in equity markets of either moderate importance or that characterize highly integrated economies (e.g. Canada), the time series dynamics of stock returns may be well explained by the overall behavior of world markets, in addition to the national index. In particular, the abnormal returns in this case are the residuals of the following OLS"regression:

$$r_t = \alpha + \beta r_t^M + \gamma r_t^W + \theta S_t + e_t$$

where $r_t^W$ is the MSCI total value-weighted World Index. We then constructed the $CAR$ for the "Angolan" and control portfolio following the same methodology described in section 3.1. The evolution of their $CAR$ in correspondence with the two end-of-conflict events, namely Savimbi's death and the cease-fire, is portrayed in figures A3 and A4 for the "Angolan" and control portfolios, respectively. In all cases we confirm the results obtained with the market model.

[Insert Appendix Figures A3, A4]

## A3. Nearest Neighbor Polynomial Regressions

The idea of nearest neighbor regressions is to perform polynomial regressions"to form a sample estimate of $E[y_n|x_j]$ by using all the pairs $(y_n, x_n)$ such that $x_n$ is in some sense close to (in a neighborhood of) $x_j$. In our application, for all values of the regressor $x$ (called $x_j$), we indirectly (implicitly) set the size of the neighborhood $N(x_0)$ by applying a weight to all observations $x_k \neq x_j$ that depends on their distance from $x_j$. Usually, when $|x_k \neq x_j|$ exceeds some threshold, the weight is set to zero. Our choice relies on the use of tri-cube weights:

$$w_n(x_j) = \begin{cases} \left[1 - \left|\frac{d_n}{d_*}\right|^3\right]^3 & \text{for } |d_n/d_*| < 1 \\ 0 & \text{otherwise} \end{cases}$$

with $d_n \equiv |x_k - x_j|$ and $d_*$ is the $N(x_j) \equiv int(\alpha N)$ smallest distance when distances $d_n$ are ranked from the highest to the smallest using the full sample of data. We take $\alpha$ to be generally close to 1 (between 0.8 and 1), and let the tri-cube weights define the nearest neighbors. The $p$-th order polynomial regression estimator is then simply found by solving (see Fan and Gijbels (1996)):

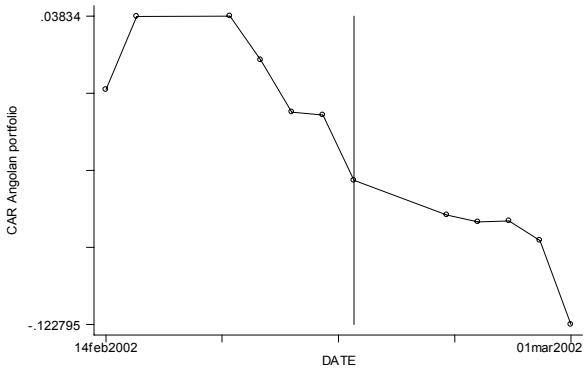
$$\hat{\boldsymbol{\beta}}(x_j; w(x_j)) \equiv \underset{c_0, c_1, \ldots, c_n}{\arg\min} \sum_{n=1}^{N} w_n(x_j) \left\{ [y_t - c_0 - \sum_{i=1}^{p} c_i (x_k - x_j)^i]^2 \right\}.$$

The statistical properties of $\hat{\boldsymbol{\beta}}(x_j; w(x_j))$ are similar to those of kernel density regressions with tricubic-type kernels; hence (under some regularity conditions) consistency and asymptotic normality of $E(y|x_j)$ follow.

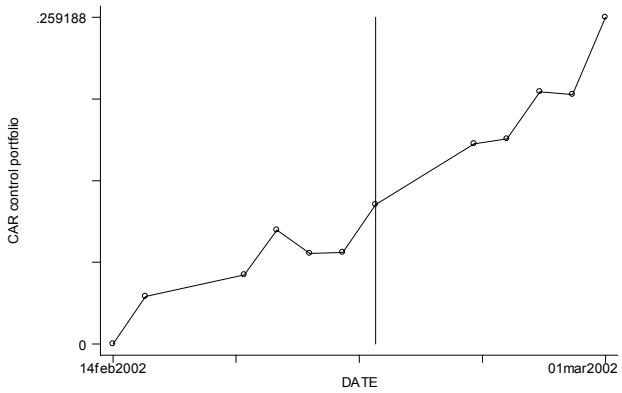
In particular, we make the neighborhood symmetric around $x_j$: $N(x_j)$ is then adjusted to include a number of observations as close as possible to $int(\alpha T)$. Additionally, we also perform a few (usually four) rounds of supplementary *robustness iterations*: the local regressions are iterated after adjusting the neighborhoods $N(x_j)$ to downweight outlier observations. The initial fit is obtained using the neighborhood $N(x_j)$ $\forall j$; the local residuals $e_n(x_j) \equiv \sum_{k \in N(x_j)} \left\{ y_n - \hat{c}_0(x_j) - \sum_{i=1}^{p} \hat{c}_i (x_k - x_j)^i \right\}$ from the initial fit are used to compute robustness bi-square weights,

$$\eta_t(x_j) = \begin{cases} \left[ 1 - \left| \frac{e_n^2(x_j)}{36M^2} \right|^3 \right]^3 & \text{for } |e_n^2(x_j)/36M^2| < 1 \\ 0 & \text{otherwise} \end{cases}$$

where $M$ is the median of the series $\{|e_n(x_j)|\}_{t=1}^{N(x_j)}$. In the second iteration, the local fit is obtained using the new weights $\{\eta_n(x_j)\}_{t=1}^{N(x_j)}$. This process is repeated a few times, where at each iteration the robustness weights are recomputed using the residuals from the last iteration.

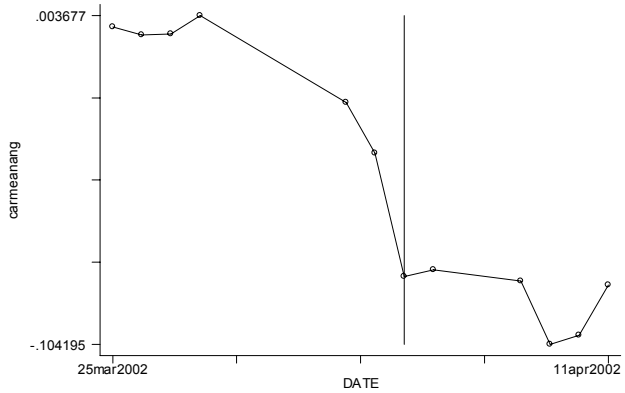



(a) Angolan portfolio

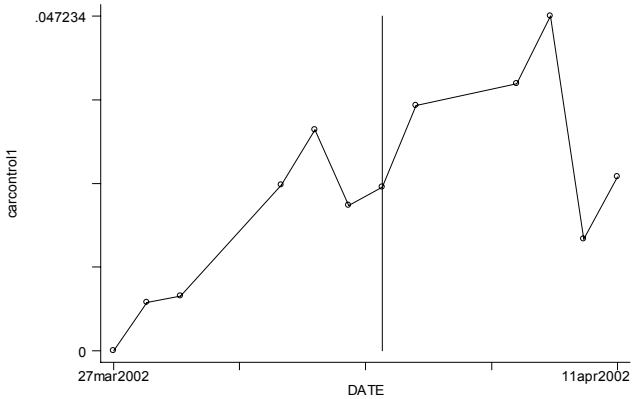



(b) Control portfolio

**Figure 1: Savimbi's death**




(a) Angolan portfolio




(b) Control portfolio

**Figure 2: Cease fire**

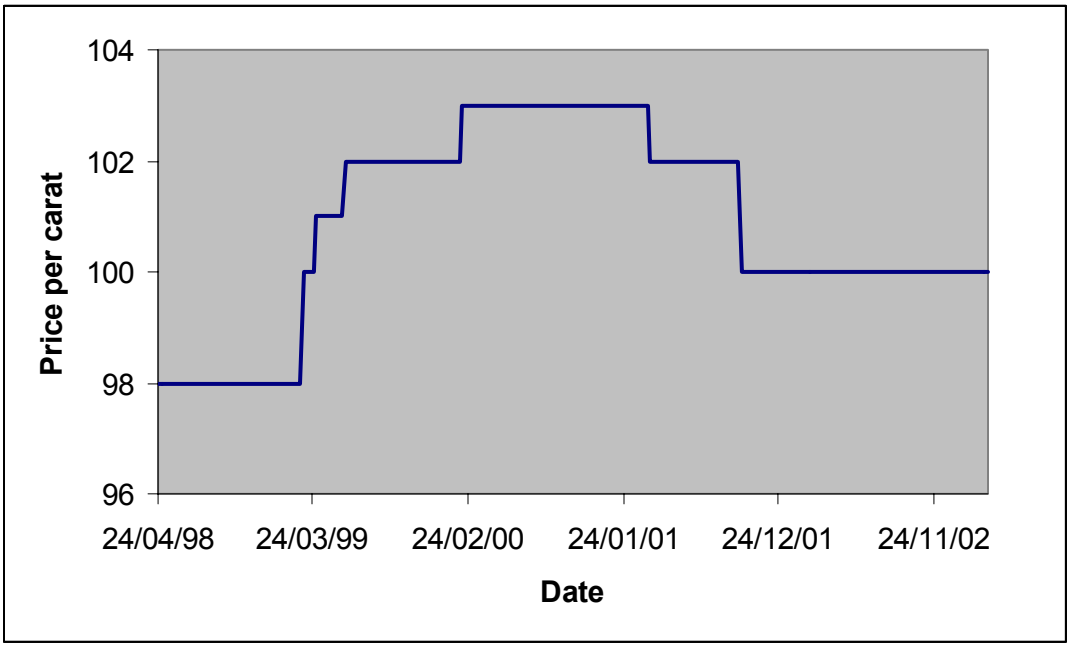
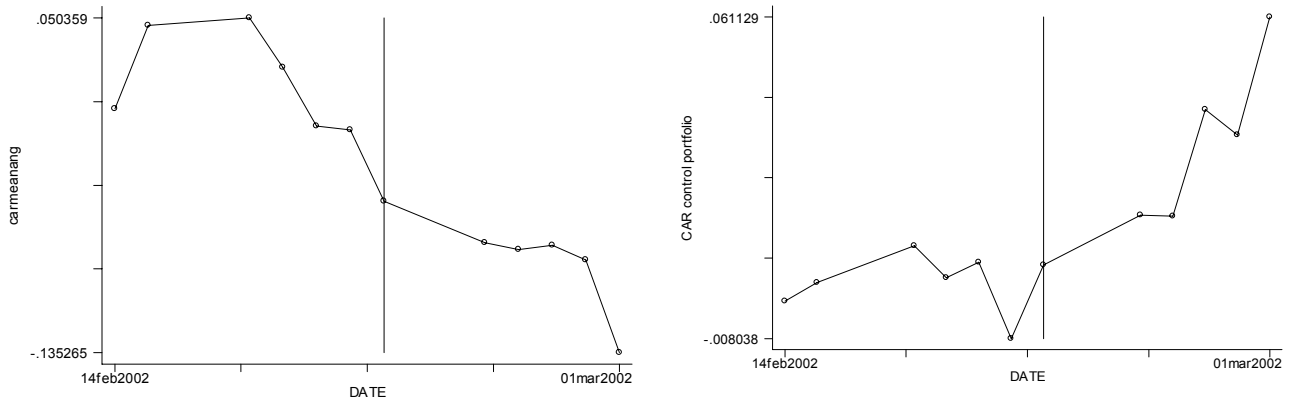
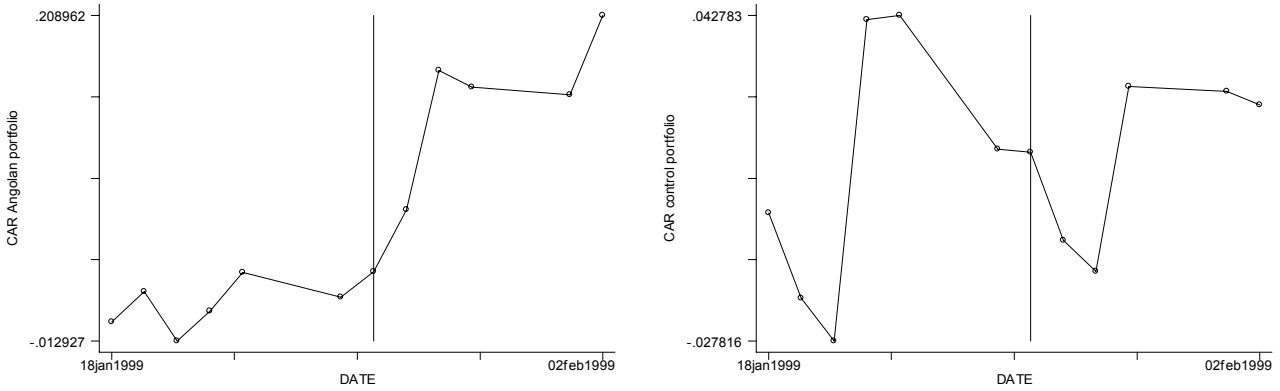



**Figure 3: Evolution of diamond prices, 1998-2003**




(a) Angolan portfolio (b) Control portfolio

**Figure 4: Savimbi's death (excluding De Beers)**




(a) Angolan portfolio (b) Control portfolio

**Figure 5: Endiama director suspended**

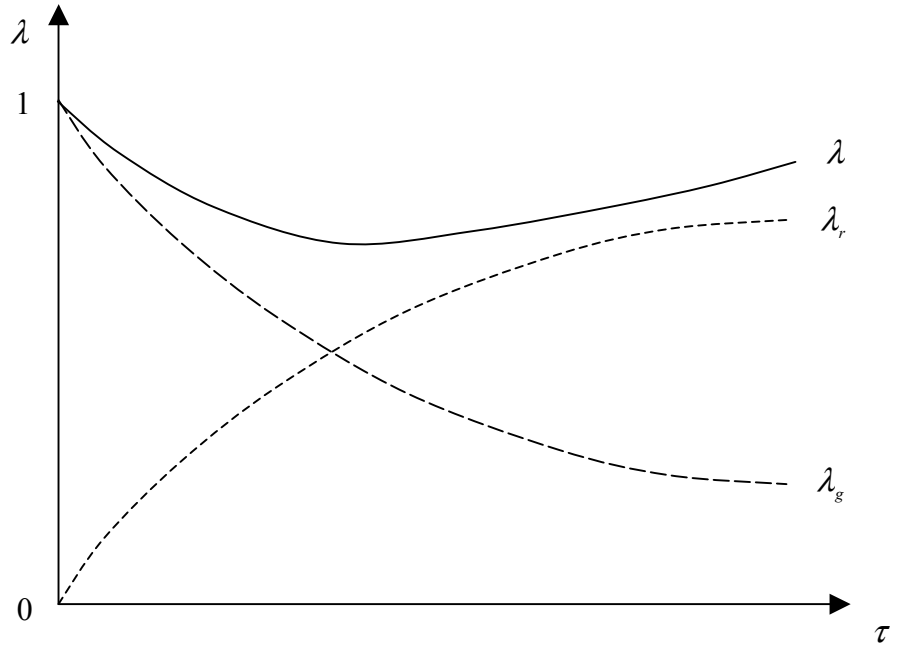
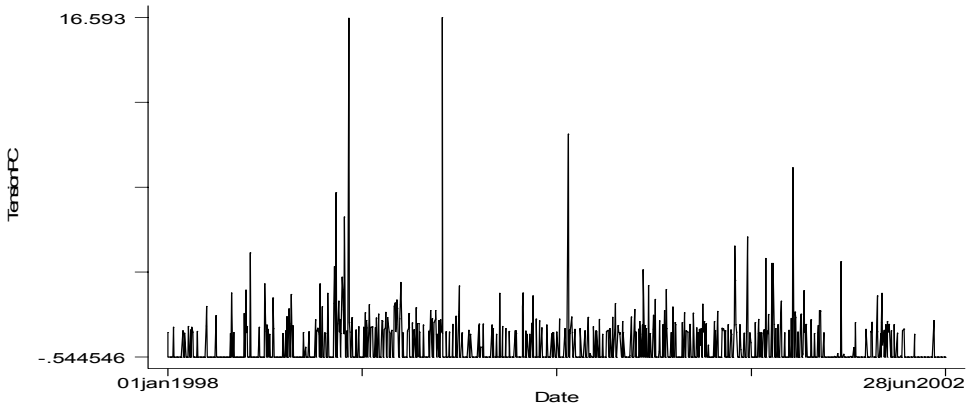
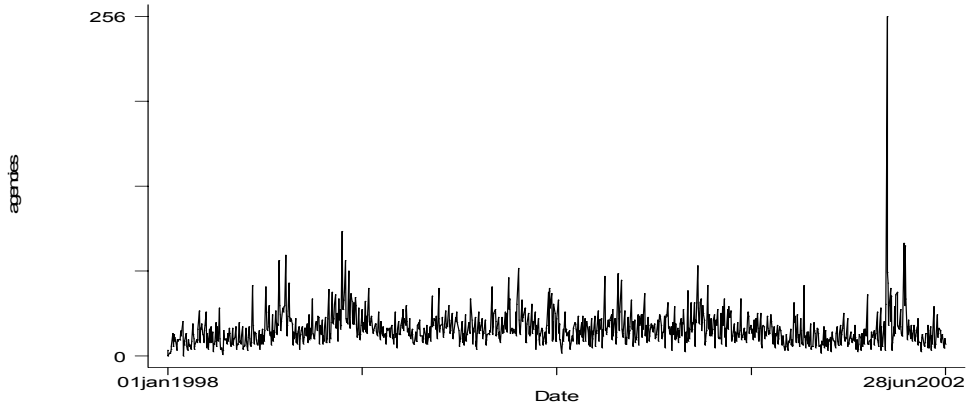



**Figure 6: Political tension and conflict outcome**

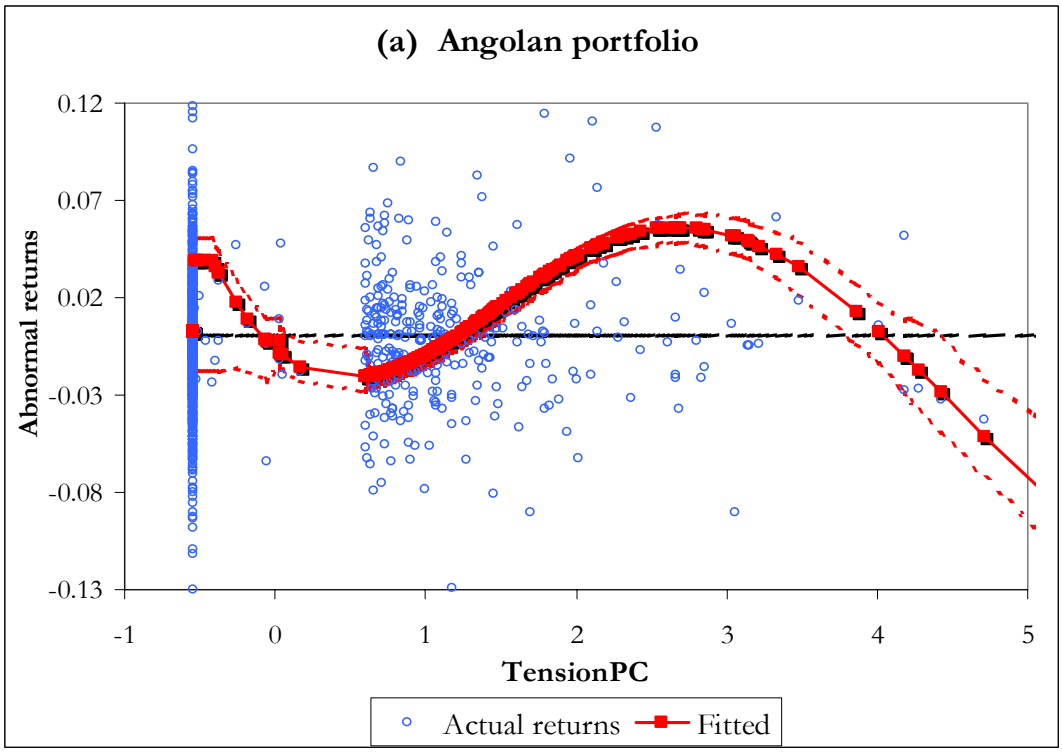



(a) TensionPC




(b) Agencies

**Figure 7: Political tension indexes**



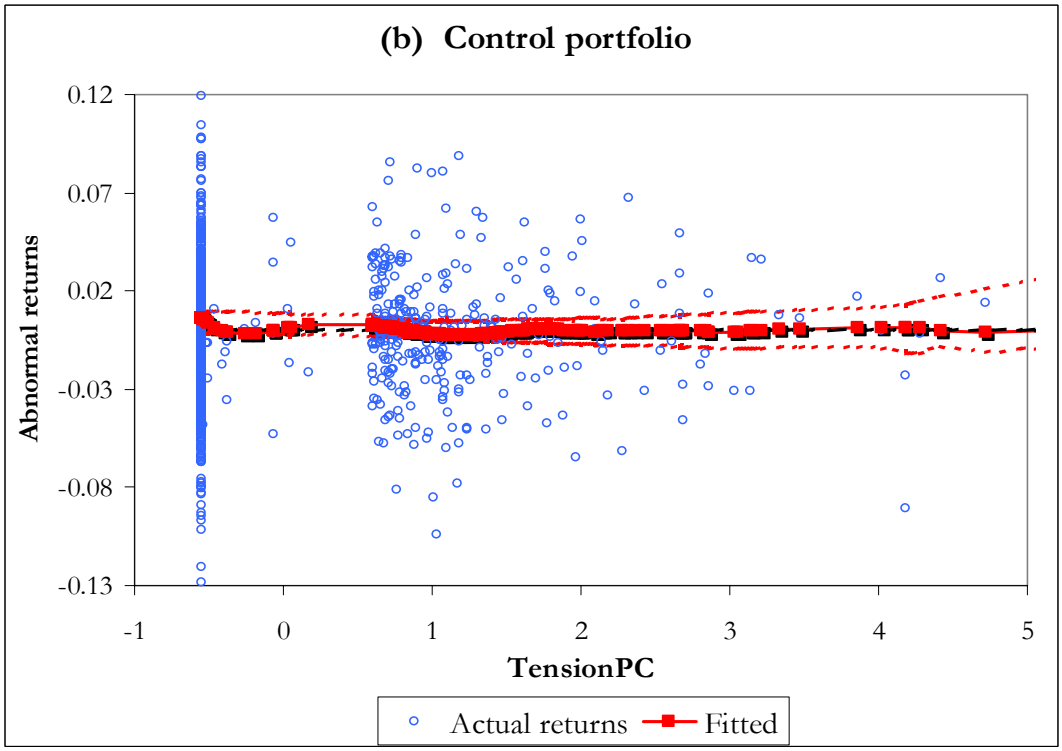
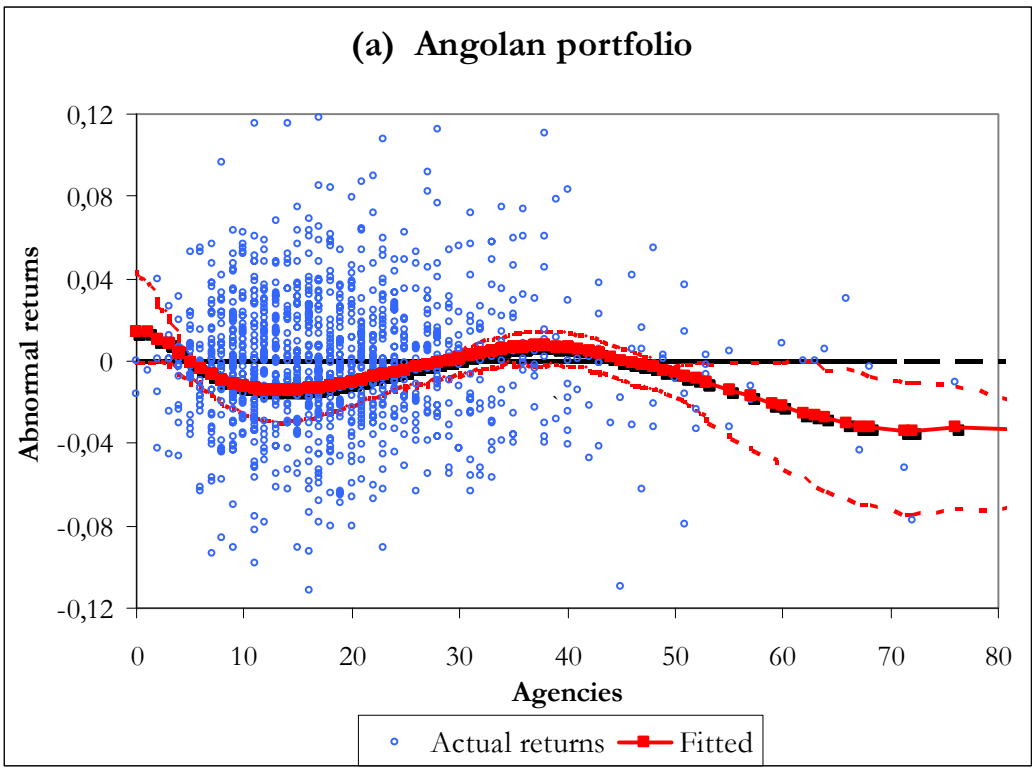




**Figure 8: Political tension and abnormal returns**



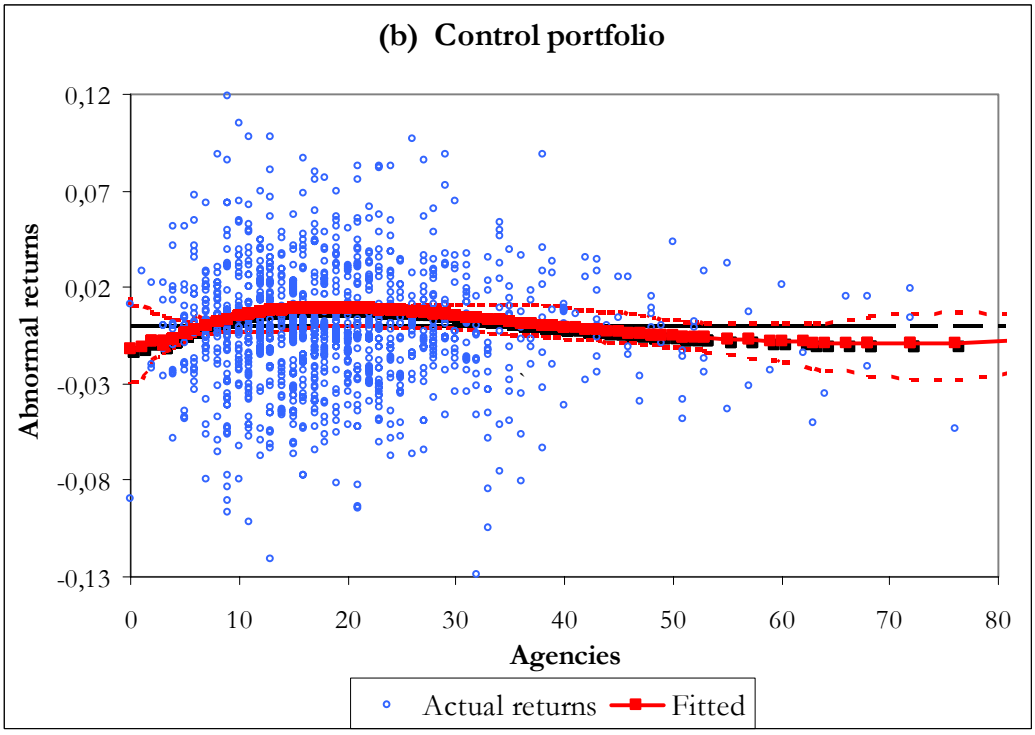




**Figure 9: Press agencies and abnormal returns**

## Table 1: Event list

| | |
|---|---|
| **End of conflict** | |
| 2/22/2002 | Rebel leader Jonas Savimbi dies. |
| 4/4/2002 | Ceasefire signed. |
| **Government victories** | |
| 1/13/1998 | UNITA hands over Cuango Valley. |
| 9/28/1999 | Voice of America: top UNITA general and 2,000 rebels surrendered in Bailundo. |
| 10/20/1999 | UNITA strongholds Andulo & Bailundo taken by FAA. |
| 12/24/1999 | UNITA historical stronghold Jamba taken by FAA. |
| 9/19/2000 | FAA takes strategic town of Cazombo (Moxico province), bordering Zambia |
| 5/1/2001 | FAA takes town of Mavinga. |
| **UNITA attacks on civilians** | |
| 7/24/1998 | UNITA attacks town of Bula. |
| 12/14/1998 | UNITA attacks town of Cuito. |
| 5/5/2001 | Ferocious UNITA attack on civilians in Caxito. |
| 8/10/2001 | UNITA attacks strategic train line between Luanda and Dondo. |
| **UNITA attacks on industrial mines** | |
| 11/9/1998 | UNITA attacks Yetwene mine (operated by Diamondworks). |
| 1/7/1999 | UNITA attacks Luzamba mine (operated by Ashton Mining). |
| **UNITA attacks on garimpeiros** | |
| 8/8/2000 | UNITA attacks diamond field near Camafuca. |
| 10/24/2000 | UNITA attacks diamond field near Cambulo. |
| 10/5/2001 | UNITA attacks diamond field near Kuango. |
| **Industry regulation** | |
| 10/26/1999 | Government announces plan to reform diamond marketing and to tighten control over joint ventures. |
| 1/31/2000 | Government decrees that *all* diamond sales must go through Ascorp. |

## Table 2: Abnormal returns and different types of events

| | "Angolan" | Control | |
|---|---|---|---|
| | | A-G weights | V weights |
| | [1] | [3] | [4] |
| End of conflict | -.032** | .015 | .022** |
| | (.009) | (.011) | (.009) |
| Government victories | .007 | -.001 | .002 |
| | (.008) | (.006) | (.010) |
| UNITA attacks civilians | .017 | -.002 | .006 |
| | (.019) | (.008) | (.018) |
| UNITA attacks mines | -.034* | .036* | .036** |
| | (.017) | (.021) | (.015) |
| UNITA attacks garimpeiros | -.014 | -.004 | -.009 |
| | (.015) | (.024) | (.019) |
| Industry regulation | -.011** | .000 | -.029 |
| | (.004) | (.007) | (.021) |
| Company fixed effects | Yes | Yes | Yes |
| No. obs. | 8,079 | 47,095 | 47,095 |

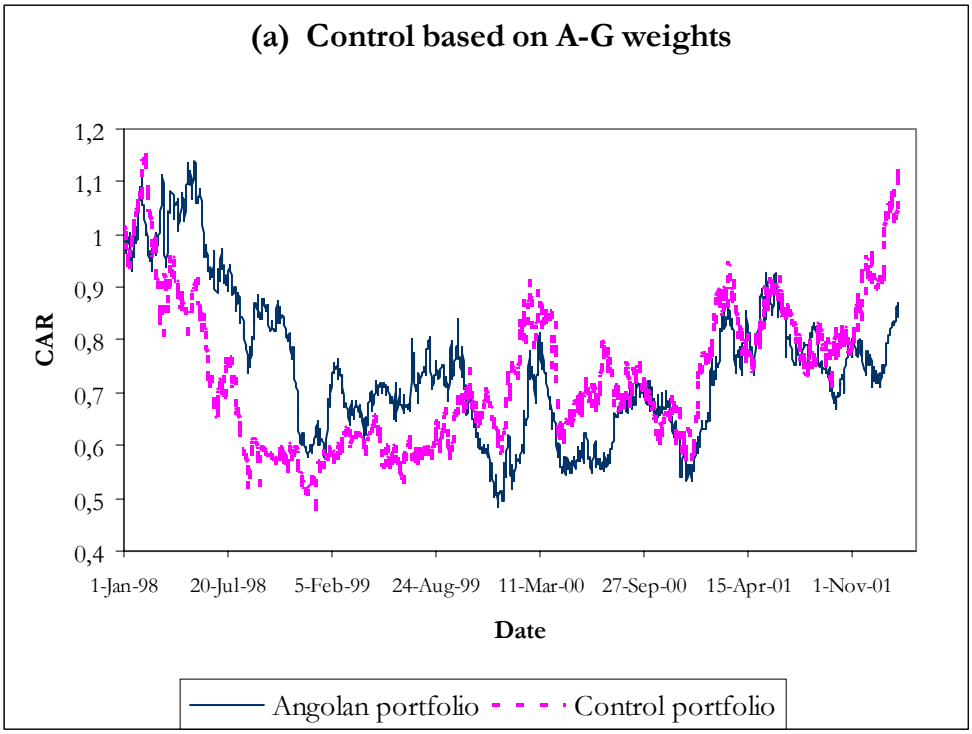
Notes:
Table reports estimated OLS coefficients. Standard errors in parenthesis are corrected for heteroskedasticity and clustering of the residuals at the company level.
* denotes significance at the 10 percent level, ** at the 5 percent level.

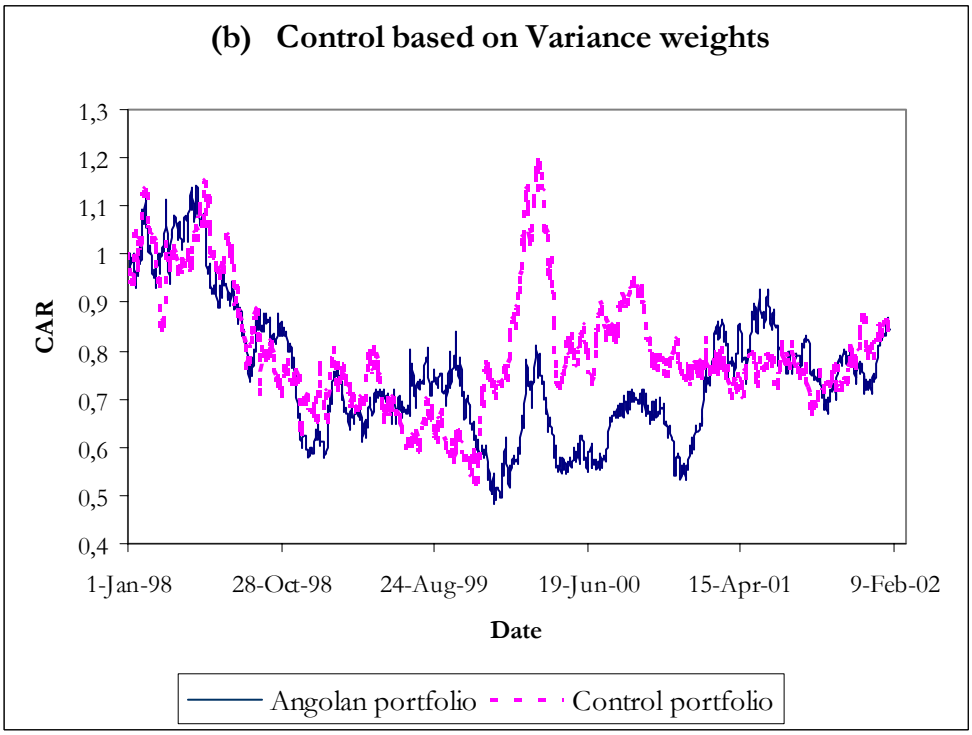
# Appendix Tables and Graphs

## Appendix Table A1: Composition of Control Portfolio

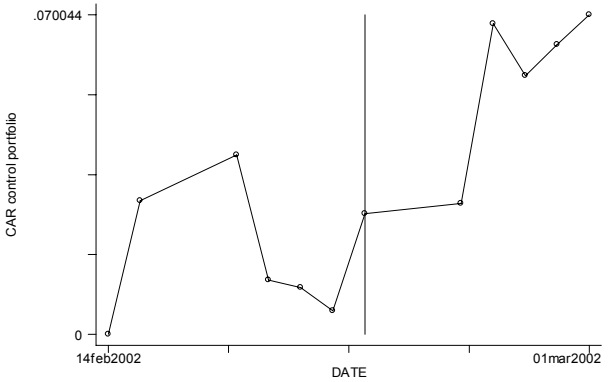
| | *Incl. De Beers* | | *Without De Beers* | |
|---|---|---|---|---|
| | *Variance weights* | *A-G weights* | *Variance weights* | *A-G weights* |
| **AKD** | 0.000740 | 0.010477 | 0.000692 | 0.022101 |
| **ALCASTON MINING** | 0.322474 | 0.006931 | 0.362810 | 0.023644 |
| **BHP BILLITON** | 0.007829 | 0.000509 | 0.005835 | 0.019429 |
| **CONQUEST MINING** | 0.002982 | 0.021795 | 0.002577 | 0.009742 |
| **CROWN DIAMONDS** | 0.022246 | 0.008443 | 0.017354 | 0.012280 |
| **GONDWANA RESOURCES** | 0.042796 | 0.013287 | 0.044958 | 0.010789 |
| **GRAVITY CAPITAL** | 0.012951 | 0.017100 | 0.009458 | 0.014518 |
| **KIMBERLEY DIAMOND** | 0.010838 | 0.010684 | 0.009968 | 0.021420 |
| **MOUNT BURGESS MINING** | 0.001082 | 0.008603 | 0.000962 | 0.013136 |
| **OROPA** | 0.000105 | 0.012539 | 0.000091 | 0.011256 |
| **PLENTY RIVER CORP.** | 0.001267 | 0.010051 | 0.001090 | 0.005860 |
| **REEFTON MINING** | 0.000062 | 0.040211 | 0.000054 | 0.011251 |
| **RESOURCE MINING** | 0.001510 | 0.015470 | 0.001653 | 0.013031 |
| **RIMFIRE PACIFIC MINING** | 0.000307 | 0.009562 | 0.000275 | 0.470814 |
| **TAWANA RESOURCES** | 0.128893 | 0.001658 | 0.067550 | 0.005148 |
| **AFMINEX** | 0.000292 | 0.021050 | 0.000257 | 0.008219 |
| **CLUFF RES. PAC** | 0.002982 | 0.010592 | 0.002415 | 0.021610 |
| **GOLDSEARCH** | 0.004222 | 0.040666 | 0.003395 | 0.010416 |
| **STRIKER RESOURCES** | 0.007642 | 0.006108 | 0.006338 | 0.005808 |
| **ASTRO MINING** | 0.020920 | 0.020919 | 0.051602 | 0.010928 |
| **FORTUNE MINERALS** | 0.000530 | 0.002566 | 0.000456 | 0.008076 |
| **GUYANOR RES.SA (TSE)** | 0.023896 | 0.024351 | 0.045877 | 0.006652 |
| **PLATINOVA A/S** | 0.000503 | 0.023102 | 0.000419 | 0.006480 |
| **SOUTHWESTERN RES.** | 0.001558 | 0.002771 | 0.001343 | 0.012026 |
| **ABER DIAMOND** | 0.011098 | 0.001223 | 0.007921 | 0.010428 |
| **DIAMOND FIELDS INTL.** | 0.008398 | 0.003664 | 0.007183 | 0.017018 |
| **ETRUSCAN RESOURCES** | 0.001746 | 0.138440 | 0.001542 | 0.008651 |
| **REX DIAMOND MNG.** | 0.001257 | 0.001728 | 0.000946 | 0.007419 |
| **BAND ORE RES.NEW** | 0.001514 | 0.012428 | 0.001326 | 0.006390 |
| **BRAZILIAN DIAMONDS** | 0.005741 | 0.021033 | 0.003978 | 0.012025 |
| **CALDERA RES.** | 0.077662 | 0.038493 | 0.071109 | 0.017491 |
| **COMAPLEX MINERALS** | 0.106517 | 0.004729 | 0.139356 | 0.031977 |
| **GOLDEN STAR RESOURCES** | 0.000646 | 0.006813 | 0.000620 | 0.007477 |
| **MOUNTAIN PROV.DIAS.** | 0.010972 | 0.004452 | 0.008316 | 0.012334 |
| **PURE GOLD MRLS.** | 0.049468 | 0.011660 | 0.023897 | 0.056215 |
| **SUDBURY CONTACT MNS.** | 0.000666 | 0.015087 | 0.000580 | 0.005775 |
| **TAHERA** | 0.004296 | 0.014619 | 0.003790 | 0.005153 |
| **RNC Gold** | 0.002504 | 0.135893 | 0.002019 | 0.009129 |
| **AFRICAN GEM RES.** | 0.001972 | 0.000775 | 0.001505 | 0.011734 |
| **GOOD HOPE DIAMONDS** | 0.083849 | 0.098646 | 0.081465 | 0.006685 |
| **THABEX EXPLORATION** | 0.001308 | 0.133183 | 0.001151 | 0.009821 |
| **ZENITH CONCESSIONS** | 0.011762 | 0.017689 | 0.005863 | 0.009643 |

Notes:
The weights in columns 1-2 are obtained for an "Angolan" portfolio that includes De Beers. Those in columns 3-4 for a portfolio that does not include De Beers.

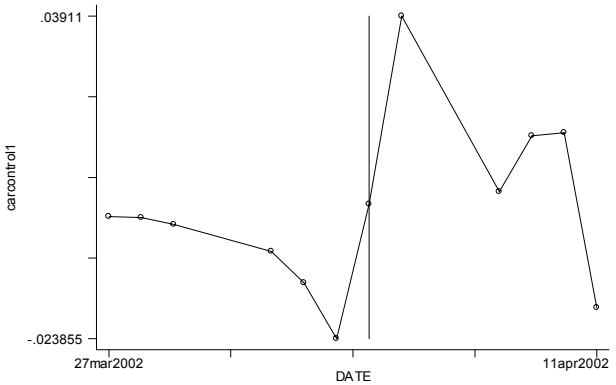



**Appendix Figure A1:**
**CAR of Angolan and control portfolio, full sample**

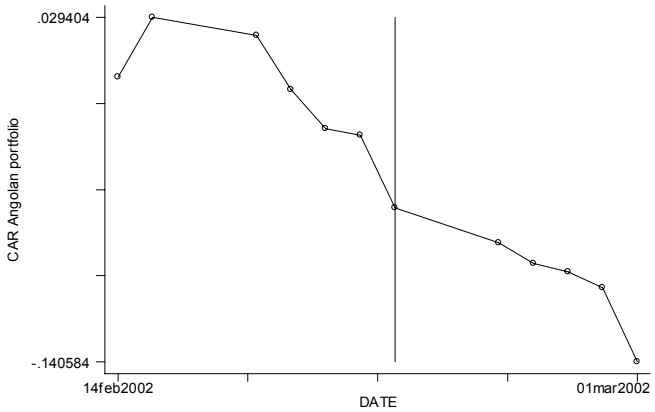



(a) Savimbi's death

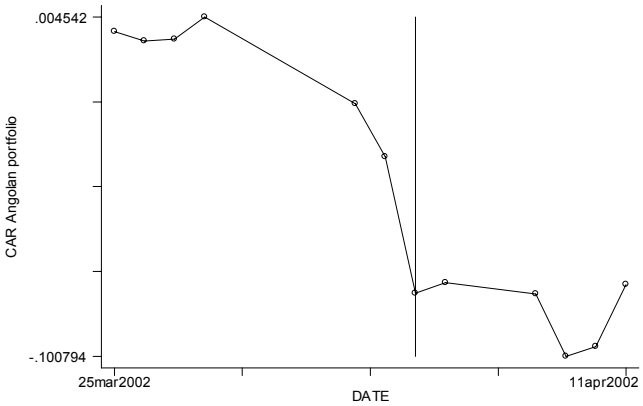



(b) Cease-fire

**Appendix Figure A2:**
**End of conflict, Control Portfolio using Variance weights**

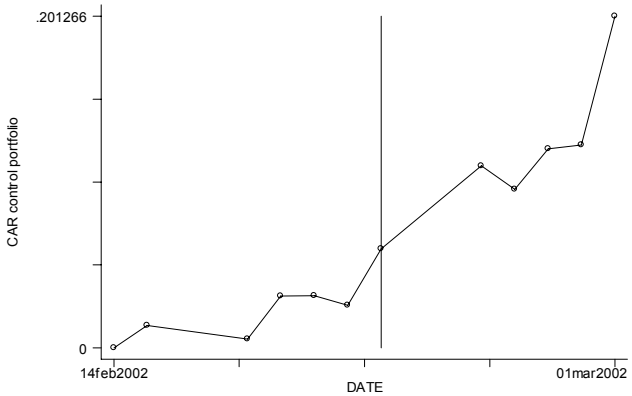



(a) Savimbi's death

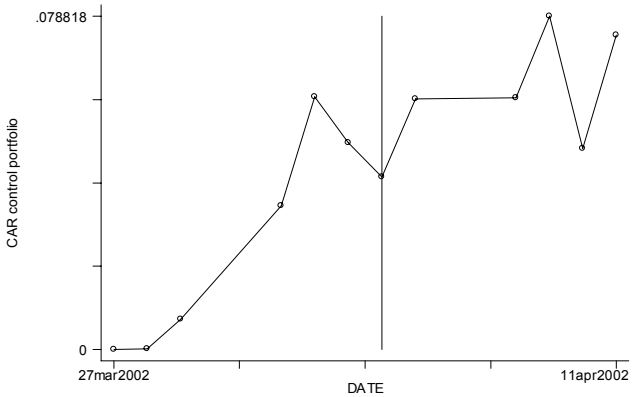



(b) Cease-fire

**Appendix Figure A3:**
**End of conflict, Angolan portfolio**
**Multi-factor model**

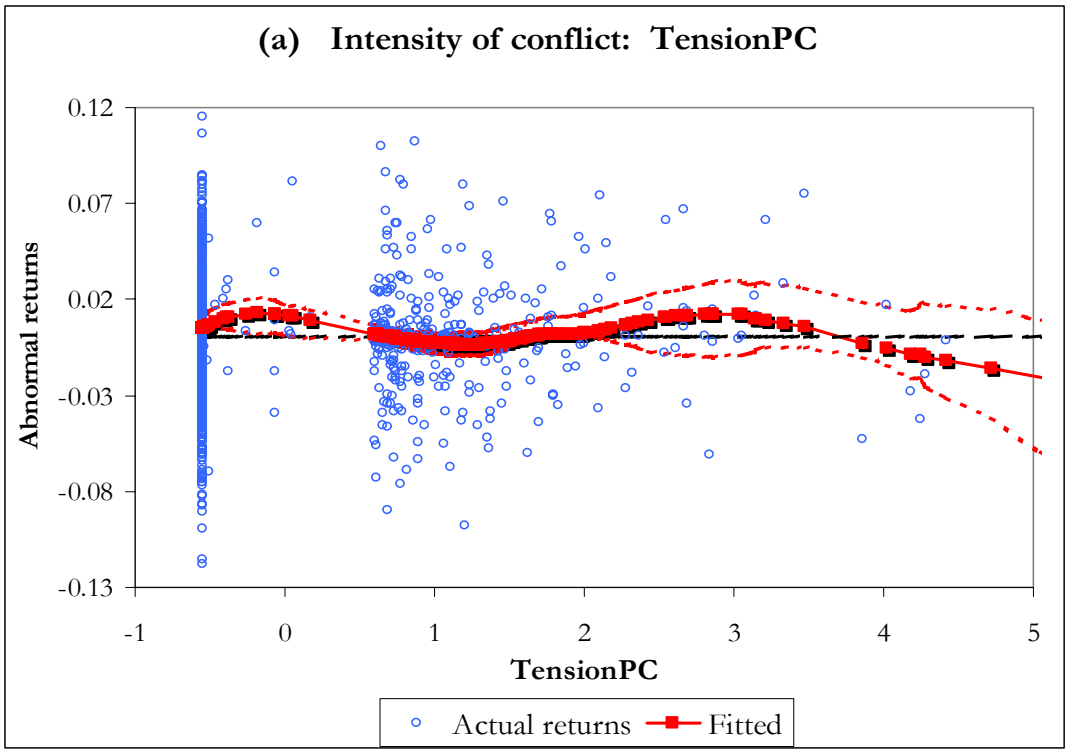


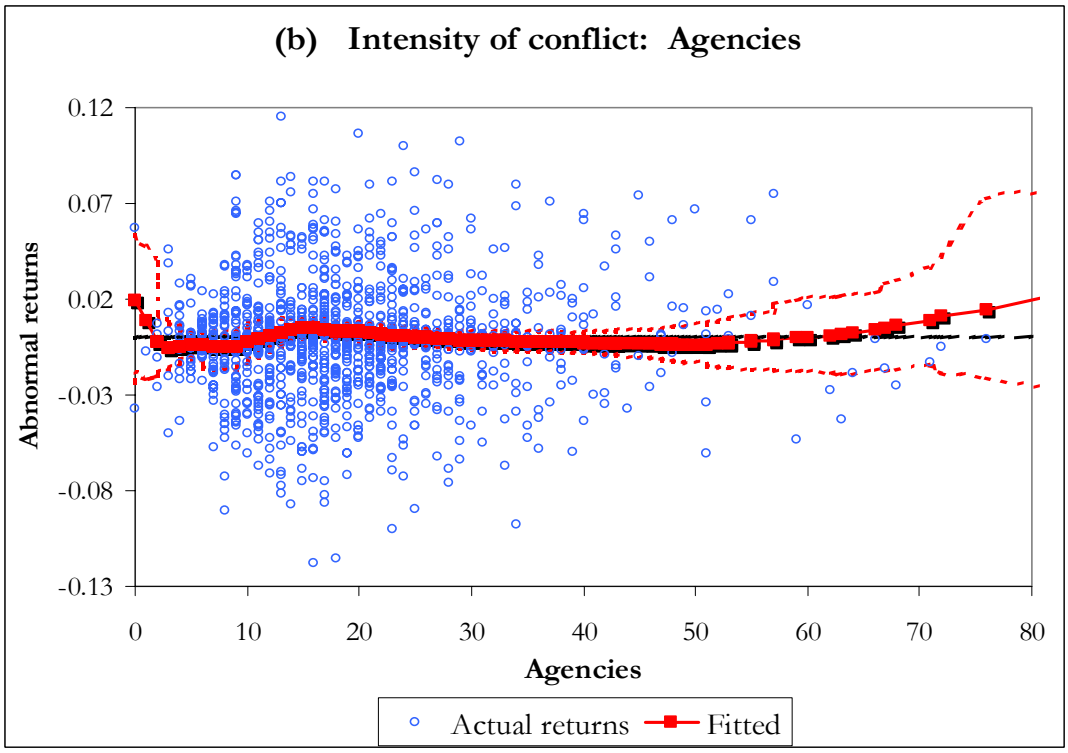

(a) Savimbi's death




(b) Cease-fire

**Appendix Figure A4:**
**End of conflict, Control portfolio**
**Multi-factor model**




**Appendix Figure A5:**
**Local Polynomial Regressions**
**Control Portfolio using Variance weights**