Civil Conflict and Firm Recovery: Evidence from Côte d’Ivoire

FLORIAN LÉON & IBRAHIMA DOSSO

†Foundation for Studies and Research on International Development (FERDI), Clermont Ferrand, France
‡Independent Researcher, Abidjan, Côte d’Ivoire

Abstract

This paper examines how firms bounce back after a short, albeit severe, civil conflict. Thanks to a rich firm-level database, we follow surviving enterprises before, during and after the 2011 post-electoral crisis in Côte d’Ivoire. Main findings are summarized as follows. First, recovery was rapid in the first year but imperfect: 3 years after the shock, firms did not reach their pre-crisis level of productivity. Second, we show a wide heterogeneity in recovery across firms according to their initial characteristics (before the crisis). Young and local firms are more able to rebound after the crisis. In addition, credit-constrained firms are less resilient, highlighting the importance of access to credit in post-crisis periods. Finally, the recovery is quicker for labor-intensive firms; but firms relying more on skilled workers are less likely to rebound.

Keywords: Firms; conflict; recovery; Africa; political violence

1. Introduction

Private firms in developing economies are essential to wealth and job creation, but they often have to contend with the effects of frequent external shocks, such as commodity price busts, natural disasters, health shocks and conflicts. In Africa, internal conflicts are a common source of instability, particularly at election times. Despite a large body of literature on the consequences of civil conflicts on socioeconomic outcomes (Verwimp, Justino, & Brück, 2019), our knowledge about the implications of conflicts on firms and entrepreneurship remains limited. In particular, we know little about firm recovery after a civil conflict.

A better understanding of how firms bounce back after a shock is of prime importance in helping policymakers formulate policies that strengthen firm resilience, and therefore foster peace in post-conflict countries. The persistent effects of conflicts, particularly short-term events, on an economy is ambiguous (Blattman & Miguel, 2010). On the one hand, the disruption of business and the destruction of (human and physical) capital may be too limited to have a profound or long-term effect. In addition, a rebound of economic activity may occur after a negative event due to reconstruction and/or because the crisis has had a cleansing effect. On the other hand, even short-lived shocks may have long-term effects on firms due to the loss of specific assets (Collier & Duponchel, 2013) or delayed investment decisions (Baker, Bloom, & Davis, 2016). Furthermore, conflicts negatively affect human capital accumulation (education

Correspondence Address: Florian Léon, Foundation for Studies and Research on International Development (FERDI), Clermont Ferrand 63000, France. Email: florian.leon1@ferdi.fr

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and health), public finance, inter-personal trust, and social cohesion, thus impeding long-term economic growth.

In this article, we examine how firms recover following a short, albeit severe, civil conflict. We examine the performance of the universe of formal firms operating in Côte d’Ivoire before, during and after the 2011 post-electoral crisis (or second civil war). The Ivorian context is especially appropriate for our objective as this crisis erupted in the context of latent tensions. It was relatively short-lived (less than 6 months) but devastating (resulting in more than 3,000 deaths and over 700,000 displaced persons). It was also followed by a quiet period (Figure 1), which is of prime importance to the study of recovery.

To assess how firms bounce back after a conflict, we track the evolution of the productivity of surviving firms in Côte d’Ivoire before (2009–2010), during (2011) and 3 years after the electoral crisis (2012–2014). We exploit heterogeneity across firms to examine factors affecting firm recovery.

Our analysis indicates that, on average, firms partially recovered 3 years after the crisis. During the hostilities, the level of (labor) productivity decreased on average by 20%. One year after the conflict, half of the firm losses had been recouped. However, 3 years after the crisis, the level of productivity remained ten percent lower than in the pre-crisis period. We find that the negative effect on firm productivity is due to a reduction in value added rather than to a change in employment levels.

We show a wide heterogeneity in recovery across firms, according to their initial, pre-crisis characteristics. Small (in terms of employees) and local firms recover quickly. However, there are some minor differences both across sectors and between young and old firms.

Input mix before the crisis strongly influences firm recovery. Firms with lower access to credit suffer more than their counterparts. Interestingly, we find that access to capital plays a role after the crisis but does not help firms to limit losses during the conflict (many banks closed

**Figure 1.** Number of fatalities per year and major events.

*Note: Light grey refers to the number of fatalities in Abidjan and dark grey to those in other cities. We report the major events as well as the sample used in this paper. Source: ACLED (authors’ computation).
during the fighting). Finally, we highlight that the relationship between labor and recovery is complex. Labor-intensive firms outperform their counterparts both during and after the crisis. However, workforce composition matters for understanding which firms rebound. Firms that rely more on skilled workers and managers are less able to bounce back. After the conflict, these skill-intensive firms hired more (low-skilled) employees, certainly to compensate the leave of their key workers (highly qualified workers, managers). However, these firms failed to return to their initial value-added level.

The baseline results are robust to a battery of sensitivity tests. We change the definition of dependent variable by considering alternative measures of productivity and outcomes. We also exploit different measures and databases to compute conflict intensity. Furthermore, we change the way we define input mix before the crisis. Finally, we account for econometric issues, especially sample selection because we focus on surviving firms. The main findings are not altered by these changes.

Our research contributes to a burgeoning literature on the impact of civil conflicts on firms. Recent works show that violent acts seriously disrupt business activities by reducing the performance of surviving businesses (for example, Dupas & Robinson, 2010; Klapper, Richmond, & Tran, 2013; Amodio & Di Maio, 2018; Rozo, 2018), inducing exits (Camacho & Rodriguez, 2013), changing firm location (Blumenstock et al., 2020), reducing firm diversity (Ríos, 2019) and spurring the growth of the informal sector (Bozzoli, Bruck, & Wald, 2013). To our knowledge, however, only two papers examine how firms perform in the wake of an armed conflict. Ksoll, Macchiavelo, & Morjaria (2019) point out that the impact of Kenya’s 2008 post-electoral crisis on the flower industry was short-lived. Despite widespread worker absenteeism during the crisis, firms were able to rebound within few days. Collier and Duponchel (2013), however, document that 5 years after the end of fighting in Sierra Leone, companies located in the most affected areas still lagged behind their pre-conflict production levels.

Our paper extends the scant literature on firm recovery by providing more robust evidence. We include in the analysis the universe of formal firms (contrary to Ksoll et al., 2019) and we exploit information on firms before, during and after the crisis (contrary to Collier & Duponchel, 2013). In addition, we reconcile findings from both studies, as well as provide new results. An important difference that may explain the contradictory conclusions between Collier and Duponchel (2013) and Ksoll et al. (2019) is the duration of the conflicts studied (respectively, 11 years and 2 months). In this work, we examine a short-armed conflict (less than 6 months) but one that occurred in a very politically unstable country. In this context, even a short event may have a persistent effect on economic activity. In addition, both of the above-mentioned papers focus on the importance of workforce. Our work documents that the relationship between labor and resilience is complex, helping to explain contradictory findings from both papers. Skill composition of labor is crucial to understanding why some firms are not able to bounce back. Firms employing a majority unskilled workforce (such as those in the flower industry examined by Ksoll et al., 2019) are more likely to recover, as their workers are easily replaceable with little to no productivity costs (learning by doing is achieved in several days). However, replacing key employees (managers, highly-skilled workers) can have significant productivity costs, for firms that rely on a more complex production process. In these types of firms, new employees need time to reach the productivity levels of the workers they have replaced. In addition, re-hiring skilled workers has a limited effect because their skills depreciate over time (Edin & Gustavsson, 2008) or because complementary production factors for these skilled workers (such as physical capital) are lacking. Finally, we shed light on the importance of access to capital in strengthening firm resilience after a crisis. This finding indicates that financial access is not only important in normal times but also after the occurrence of a shock, as highlighted in other contexts (Berg & Schrader, 2012; Bolton, Freixas, Gambacorta & Mistrulli, 2016).
This paper also adds to the discussion on how conflicts disproportionately affect some firms by creating or reinforcing (input) market deficiencies. Guidolin and La Ferrara (2007) have shown that war is not always bad news for firms and point out that the end of the war in Angola was detrimental for diamond enterprises there. Nevertheless, in general, the majority of companies suffer, but to varying degrees. The functioning and accessibility of markets to buy inputs or sell products are affected by conflicts, and some firms are more vulnerable to an increase in market frictions than others. Amodio and Di Maio (2018) document that Palestinian firms exposed to conflict substitute domestically produced materials for imported inputs during the Second Intifada. Jola-Sanchez and Serpa (2021) show that conflict intensity changes the quantity and composition of inventories in Colombia, signaling that firms try to protect them. Some papers point out that (mobility or trade) restrictions for security purposes during a conflict disproportionately affect some firms or industries, due to their reliance on labor or imported goods (Cali & Miaari, 2018; Amodio, Baccini, and Di Maio, 2021). In line with these articles, we show that the production process and input mix before a crisis influence a firm’s ability to rebound. In particular, and in line with Amodio and Di Maio (2018), we point out that considering the composition of one input (labor in our context, materials in theirs) is crucial to understanding a firm’s response to a conflict. In addition, we show that input mix matters not only during the civil unrest but also afterwards.

Our article also contributes to the analysis of recovery after a conflict by providing a micro-level analysis of this process, while evidence is mainly extracted from macroeconomic papers. There is quite a lot of controversy in the literature regarding the long-term effects of civil conflicts on economic activity (see Blattman & Miguel, 2010). Several empirical investigations give support to this view by focusing on major wars or bombing episodes (Organski & Kugler, 1977; Davis & Weinstein, 2002; Miguel & Roland, 2011). However, recent macroeconomic studies point out that the costs of conflict are typically very great and recovery is partial (Cerra & Saxena, 2008; Mueller, Piemontese, & Tapsoba, 2017; Novta & Pugacheva, 2021). In addition, a large body of literature highlights that civil wars have long-term impact on health and education (see Verwimp et al., 2019). The recovery process is rarely investigated at the micro-level, despite the importance of better understanding channels through which recovery occurs. Our work adds to this literature by focusing on a firm’s ability to bounce back. We provide evidence in line with the partial recovery hypothesis. Even if firms are able to rebound in the short-term, they do not generally experience a complete recovery. Obviously, our contribution is limited by the time dimension but shows that even 3 years after the end of hostilities firms in Côte d’Ivoire have not experienced quicker gains in productivity.

Finally, our work adds to a small body of literature focusing on political crises in Côte d’Ivoire. Several papers have investigated the impact of the first Ivorian civil war (1999-2005) on economic and social outcomes and found it had a detrimental impact on child health (Minoiu & Shemyakina, 2012) and education levels (Dabalen & Paul, 2014). Closest to our paper is Klapper et al. (2013) who study the effects of this first Ivorian crisis on firms. They find an approximate 20% loss of productivity during the hostilities. The decline was still strong for foreign companies and companies employing foreign employees, as well as for companies in sectors that rely on imported inputs. However, the authors focus on short-term effects (the first Ivorian crisis did not ended in 2003). We confirm their main results regarding the role of firm characteristics (age, size, foreign ownership) and extend these results by showing how dependence on inputs shape recovery across firms.

The paper proceeds as follows. Section 2 describes the political context in Côte d’Ivoire. Section 3 explains our main arguments and hypotheses. Section 4 presents the data used in the empirical section. Section 5 discusses the methodology. Section 6 presents results. The last section concludes.
2. Context

Following the death of Felix Houphouët Boigny (in power since Independence in 1960), Henri Konan Bédié was appointed president in 1993. In a context of economic decline and political and ethnic tensions, Konan Bédié was deposed from power by General Robert Gueï following a coup d'état on Christmas Eve 1999. Presidential elections were held a year later. Laurent Gbagbo, the historic opponent of Houphouët Boigny, rose to power following violent clashes between his supporters and those of General Gueï.

This situation led to the failed coup d'état of September 2002 and to the death of Gueï. The failed coup turned into a rebellion and the country was divided into two parts. The central, northern and western zones were controlled by the rebel forces of the Patriotic Movement of Côte d’Ivoire (MPCI), led by the former student union leader Guillaume Soro. The national army, in support of Laurent Gbagbo, controlled the southern zone.

After a peak in violence in 2003, tensions diminished after 2005 (Figure 1). A durable peace agreement was signed in 2007 (Ouagadougou agreement). The zone of confidence established in 2002 between Soro’s rebel forces in the north and Gbagbo’s forces in the south was dismantled. Soro became the head of government and Gbagbo remained president. Between 2005 and 2010, the country experienced a ‘no war and no peace’ situation characterized by uncertainty and sporadic small clashes.

After 5 years of postponement, presidential elections were held in 2010. After a peaceful first round, the final round (28th November) results were contested and both finalists claimed victory. Therefore, Côte d’Ivoire found itself with two presidents (Alassane Ouattara and Laurent Gbagbo) and two governments.

From January to April 2011, the country was the scene of numerous clashes between pro-Ouattara and pro-Gbagbo armed forces. In western and northern Côte d’Ivoire, pro-Ouattara forces advanced towards Abidjan. They gradually seized several cities in the country, including the capital, Yamoussoukro, on 30th March. The next day, they surrounded Abidjan. On 11th April, after several days of intense fighting, Laurent Gbagbo was arrested in Abidjan. Alassane Ouattara was instated as President of the Republic of Côte d’Ivoire on 21 May 2011 and recognized by the international community.

Despite its short duration (Dec. 2010–May 2011), the post-electoral crisis had profound human consequences. According to the National Commission of Inquiry (NCI), the civil conflict killed 3248 people, particularly in the southern (Abidjan, Lagunes) and western (Bas-Sassandra, Montagnes) parts of the country (see Figure A2 in the Supplementary Materials). In addition, the post-electoral crisis caused the displacement of nearly 735,000 persons (Abidjan is a center of internal and regional migration). Several families fled the country, a state of emergency was declared, and thousands of foreigners, who often manage firms, were evacuated (including nearly 12,000 French nationals).

The post-electoral crisis also had significant short-term economic consequences. Ivorian cocoa was under embargo. Many banks closed for several months, and there was a shortage of medicines. The country’s main refinery was no longer able to buy crude oil and was at a standstill, which resulted in fuel and food shortage (sugar, meat, oil) whose prices skyrocketed. In short, the economy was at a standstill.

Since the end of conflict in 2012 (see Figure 1), the country has experienced relative political stability and has had one of the highest growth rates in the world (over 8% on average per year). Domestic demand has driven growth, with consumption rebounding after the crisis, followed by investment development. The strong commercial recovery and government measures have produced tangible effects on employment, which has risen by 4.1% in the formal sector. At the household level, however, this growth has not translated into a significant increase in income. Indeed, GDP per capita in constant dollar terms has remained the same as in 1980. Despite an increase of minimum and public wages, nearly 58% of the heads of household...
surveyed believe that their family’s standard of living has deteriorated since 2011, compared to only 16% who report an improvement (CAPEC, 2014).

3. Theoretical framework

Our paper aims to analyze how firms bounce back after a short civil conflict. The literature on the impact of conflicts on firms draws special attention to the supply channel. Firms suffer from limited access to inputs during conflicts, whether these inputs are labor (Collier & Duponchel, 2013; Ksoll et al., 2019), capital (Singh, 2013) or intermediate goods (Amodio & Di Maio, 2018; Klapper et al., 2013). In this section, we explain how access to labor and capital may alter a firm’s performance during and after a crisis.

3.1. Labor

Firms often witness a defection of their employees during a civil war. The long-term consequences of a negative labor-supply shock are however uncertain.

3.1.1. Quantity of labor. We first consider the quantity of labor. During a civil conflict, firms suffer from worker absenteeism either because employees refuse to come to their place of work or because they are unable to (due to injury, absence or disruption of transport, movement restrictions, or workplace destruction). As a result, firms that rely on workers tend to suffer greatly during a crisis (Cali & Miaari, 2018; Ksoll et al., 2019). However, if the production process relies mainly on the workforce, these firms quickly bounce back when employees return. The negative effect of the crisis is short-lived and disappears within a few weeks when workers return to their firms. We therefore make the following hypothesis.

Hypothesis 1. Firms that rely on labor suffer more during a crisis; but they are also more able to bounce back following the crisis.

The net impact is certainly positive because the short-term shock is quickly absorbed by the return of workers.

3.1.2 Workforce composition. The workforce composition is as important as workforce quantity in assessing the impact of labor on recovery. Unskilled-labor intensive firms often employ basic technologies, and workers are easily replaceable. These firms are able to hire new workers with more or less the same level of productivity as former employees. In other words, even if previous workers never come back, the firm will be able to rapidly return to its previous productivity level. Firms that employ a majority of unskilled workers can easily find other workers without additional cost or delay. This hypothesis may explain findings from Ksoll et al. (2019). Production workers, who account for a large share of the flower industry workforce, perform relatively simple tasks (such as planting, harvesting, trimming, and packaging), which take, on average, less than 2 months for a novice to learn (Mano, Yamano, Suzuki, & Matsumoto, 2011).

In contrast, companies that employ a skilled workforce or require a manager’s ability to organize complex production suffer more when their key employees leave. Even when former employees return to their previous job after several months, there is a risk of decline in productivity for several reasons. First, skilled workers have suffered a depreciation of their knowledge, inducing lower productivity (Edin & Gustavsson, 2008). This argument is at the roots of the ‘forgetting by not doing effect’ pointed out by Collier and Duponchel (2013). In addition, even if intrinsic capabilities of skilled workers are unaffected, they often need complementary production factors. For instance, these employees rely more on physical capital (machinery, computers) that is more prone to theft or destruction during a conflict. The same argument applies...
if skilled employees work in teams and need other (skilled) workers to be productive. Third, it takes time for managers to reorganize production in a complex production process.

Finally, key workers may never return to their previous job. In Côte d’Ivoire, many top jobs were occupied by foreigners having a greater mobility and some of them never return to work after a crisis. It takes time for firms to hire new skilled workers, especially after a crisis inducing a shortage of this workforce.

To summarize, we test this second hypothesis.

**Hypothesis 2.** Firms with complex organization and/or that employ more skilled workers suffer more acutely during and after a crisis

One may, however, expect that less than 6-month duration of the shock in Côte d’Ivoire would be too short and the physical destruction too limited to have a dramatic effect on workers’ skills and that any employee migration would only be temporary.

### 3.2. Access to capital

A large body of literature has highlighted that finance is a driver of firm expansion in normal times. Many small and medium-enterprises across the world declare themselves unable to grow due to a lack of finance (for example, Beck, Demirgüç-Kunt, & Maksimovic, 2005, among others). In this work, we investigate how access to external funds also plays a central role during and after a crisis.

In the event of a negative external shock, procuring credit is a form of buffering used by a firm to try and ensure that the business bounces back as quickly as possible (De Mel, McKenzie, & Woodruff, 2012; Elliott, Liu, Strobl, & Tong, 2019). However, in Côte d’Ivoire many banks closed during the fighting. Consequently, one might expect that access to credit played a moderate role during the Ivorian crisis.

In the post-crisis period, firms who have previously built a strong relationship with formal lenders are more likely to be served first following a shock. Indeed, data from the banking supervision agency indicates that non-performing loans sharply increased during the crisis (+25%). Therefore, banks were more reluctant to grant new loans after 2011, in order to strengthen their financial ratios. We therefore expect that banks favored their well-known borrowers to the detriment of others following the crisis. The literature points out that strong bank-borrower relationships (Berg & Schrader, 2012; Bolton et al., 2016) can lower the lending restrictions observed after a shock. We therefore make the following hypothesis.

**Hypothesis 3.** Access to capital (before the crisis) does not help firms smooth the impact of the conflict; but it does help firms to bounce back after the crisis

According to Hypothesis 3, we expect the net impact of access to capital to be positive.

**Table 1** sums up the main hypothesis, as well as the coefficients expected in the econometric analysis (see Section 5). It should be noted that Hypotheses 1 and 2 are general, while Hypothesis 3 is more context-specific.

### 4. Data

#### 4.1. Dataset

Our analysis is based on firm-level data extracted from the register of formal enterprises in Côte d’Ivoire from 2006 to 2014. The enterprise database available at the National Institute of Statistics (INS) is extracted from data transmitted by tax authorities. The register covers the universe of enterprises operating in the formal sector in Côte d’Ivoire. It includes public, local
private, and foreign-owned firms operating in all industries (agriculture, manufacturing, trade, construction, services, and finance). The unit of observation is the firm; but almost all firms in Côte d’Ivoire are single-establishment firms. The data for year $t$ are collected and consolidated at the INS level during year $t+1$.

The INS register contains two types of information. First, the INS collects general information, including year of creation, location (city), industrial sector (two-digit), legal status (limited liability, public company or other status), ownership structure (public, private, foreign), and the number of employees. Interestingly for our investigation, the INS not only provides the number of employees but also the number of managers (’cadres’). Second, the database reports basic financial information extracted from balance sheets and income statements. We deflated financial data using the GDP deflator (year base = 2009).

One advantage of the database is that companies continued to be monitored during the crisis. It should also be noted that the INS checks firm-level information to detect irregularities. We are, therefore, confident in the accuracy of the data.

Despite its richness, the database comes with some shortcomings. First, a unique identifier theoretically identifies each firm. However, we observe some discrepancies in the database. To detect any possible irregularities, we develop a procedure described in the Supplementary Materials. According to this procedure, we re-code 462 firms (less than 2% of firms), and results are insensitive to this exercise of re-assignment. Second, informal firms are not included in the database. We are, therefore, blind to firm dynamics in the informal sector and to the migration between the formal and informal sectors. Finally, while the database allows us to follow post-entry performance of existing firms, it provides limited information on firm entry. Some firms enter the database after their registration (see Table A1 in the Supplementary Materials). We are theoretically equipped to disentangle ‘real entries’ and the registration of existing firms. However, the year of creation is based on a declaration by the firm that the INS does not check. In addition to data discrepancies, a new law in 2012 blurred the effect of post-crisis conditions on firm entry. It should be noted that the new legislation may explain the sharp increase in exits because new firms are more likely to exit.

### 4.2. Sample

The paper’s objective is to investigate how firms recover after the 2011 post-electoral crisis in Côte d’Ivoire. To do so, we follow a cohort of surviving private non-financial corporations operating from 2009 to 2014.

A critical point for analyzing firm recovery consists in defining proper pre-crisis and post-crisis periods. Although we have data from 2006, we exclude 2006, 2007 and 2008 in the baseline analysis. This decision is based on the recent history of Côte d’Ivoire (Section 2). We face a trade-off in selecting the pre-crisis period: Choose sufficient years before the crisis that does not overlap with the post-crisis period of the first Ivorian crisis. The first Ivorian crisis was officially over in 2007 (Ouagadougou Agreement) but combat terminated in 2005, as indicated in Figure 1. We made the choice to consider 2009 and 2010 as the pre-crisis period (benchmark) of the second conflict. The first year considered (2009) is 3 years after the end of the first Ivorian crisis.

| Hypothesis | CRISIS + POST CRISIS ($\beta_2$) | CRISIS ($\delta_2$) | POST CRISIS ($\gamma_2$) |
|------------|----------------------------------|---------------------|--------------------------|
| Hypothesis 1 | Null or positive | Negative | Positive |
| Hypothesis 2 | Negative | Negative | Positive |
| Hypothesis 3 | Positive | Null | Positive |

Note: The table reports the main hypotheses developed in Section 3 and the associated coefficient for each variable.
We expect that by this time, the effects of the first crisis have largely vanished. We consider 2010 as a pre-crisis year because the post-electoral conflict began in December 2010 but increased in intensity until March 2011 (see Figure A1 in the Supplementary Materials).

Turning to the post-crisis period, an ideal setup would involve a period without conflict. While we observe some conflicts after 2011 (Figure 1), their intensity had largely decreased by this time. In addition, economic activity regained renewed dynamism just after the post-electoral crisis of 2011 (from 2012 onwards). We therefore consider 2012 to 2014 as the post-crisis period (we are limited to the final year by data availability).

As our main interest involves firm recovery, we follow a cohort of surviving firms from 2009 to 2014. We consider only firms operating in 2009 and do not include new firms. We apply some additional filters. We exclude inactive firms, defined as firms with no sales in 2009, which sharply decreased the number of firms, from 7435 to 5200 firms. We then exclude public and semipublic firms (27 firms), as well as firms operating in finance (99 firms), domestic work and in extraterritorial business (2 firms). This leaves us with 5071 firms in 2009, as indicated in Table A1 (Supplementary Materials). We keep only surviving firms and therefore drop all exit firms from 2009 to 2014. The final sample consists of 2896 firms operating in 2009 and surviving until 2014. In the empirical analysis, we need to exclude additional firms because dependent or independent variables cannot be computed (no information on workers, negative value added). In addition, for our econometric analysis, we exclude extreme values of financial data (top and bottom percentiles). We also drop firms when input reliance cannot be computed. Our baseline analysis is therefore run on 2347 firms, that represent one half of active firms in Côte d’Ivoire in 2009. The sample retained poses the issue of sample selection due to the exclusion of firms that exited. We discuss this issue in the robustness checks section and document that the main findings are not affected by a sample selection bias.

Table 2 provides descriptive statistics of firms in 2009. There is a wide heterogeneity of productivity levels (labor productivity and total factor productivity). While the average firm has 35 employees, it should be noted that one half of firms have less than ten workers. Firms are on average 9-year old and a large majority of them are located in Abidjan (see below for a discussion of this point). One quarter of firms are foreign-owned and the majority of firms operate in trade (36%) and in services to enterprises (21%).

4.3. Variables

4.3.1. Productivity. In line with previous works (for example, Cole, Elliott, Okubo, & Strobl, 2019; Hallward-Driemeier & Rijkers, 2013), the preferred measure of firm performance is productivity. Indeed, firms in developing countries suffer from factor misallocation reflected in differences in terms of productivity (Hsieh & Klenow, 2009; Restuccia & Rogerson, 2017).

In the baseline analysis, we refer to labor productivity. In an ideal setting, we would employ total factor productivity (TFP), especially because we draw special attention to labor and access to capital. However, we are able to compute TFP for only one third of the firms due to missing data on tangible capital assets (see Supplementary Materials). We therefore consider TFP as a robustness check.

The labor productivity (LP) is defined as the value-added per worker (Hallward-Driemeier & Rijkers, 2013; Cole et al., 2019). The main advantage for us is the availability of information on value-added and workers that allows us to compute LP for all firms. Another advantage of LP is the possibility to break out its components (value-added and workers). Both sub-components are measures of firm performance in terms of wealth (value-added) and job creation (workers). In addition, by comparing the evolution of value added and workforce, we get insight on how firms cope with the shock. The value added has been deflated using the GDP deflator and translated into euros using the official exchange rate. We obtain the number of workers by taking the total number of employees plus one (the manager and/or owner).
In line with previous works (Amodio & Di Maio; Camacho & Rodriguez, 2013-2018), we combine time and spatial exposition to the conflict. We create a first time dummy $POST_t$, that takes the value of one for year from 2011 to 2014. We first consider a dummy variable considering the crisis and post-crisis periods as our primary objective is to compute the global effect. We then break down the $POST_t$ dummy between a crisis dummy for 2011 ($CRISISt$) and a post-crisis dummy for the years 2012 to 2014 ($POSTCRt$).

The crisis exposure also examines spatial heterogeneity in conflict intensity. We report the relative number of deaths in each location. Data provided by the National Commission of Inquiry (NCI) on the number of deaths in each region is reported in Table 3. The conflict variable for firm $i$ is the number of deaths per 100,000 inhabitants in the region $k$ where the firms operate ($CONF_k$). Conflict intensity ranges from 0 to 41.9 in the Guemon district in the West with a value of 31.8 in Abidjan and a mean of 27.10.

Two points regarding the measure of conflict intensity deserve special attention. First, we prefer to employ data from the NCI. The Armed Conflict Location & Event Data Project (ACLED) reports precise location (city) of each event. However, ACLED reports a limited number of deaths. The NCI’s data estimates the number of deaths as exceeding 3000, while the ACLED registered approximately 850 deaths over the same period (Table 3). More importantly

### Table 2. Characteristics of firms in 2009 (2009 cohort)

| Variable                        | Obs. | Mean  | Std. dev | Min  | Max  |
|--------------------------------|------|-------|----------|------|------|
| **Panel A: Dependent variable**|      |       |          |      |      |
| Labor productivity$^a$          | 2347 | 7279  | 12,903   | 3.53 | 406,381 |
| Total factor productivity$^a$   | 2088 | 184.3 | 577.5    | 0.8  | 10,143.5 |
| Worker                         | 2347 | 35.8859 | 107.9741 | 1    | 2562  |
| Value added$^a$                | 2347 | 224,809.7 | 562,710.9 | 21.04 | 4,863,284.0 |
| **Panel B: Input**             |      |       |          |      |      |
| **B1: Labor**                  |      |       |          |      |      |
| Staff cost                     | 2347 | 0.19  | 0.21     | 0.00 | 1.97  |
| Manager                        | 2347 | 0.29  | 0.89     | 0    | 25.33 |
| Avg. wage                      | 2347 | 3639  | 3855     | 80.23| 26,405 |
| **B2: Capital**                |      |       |          |      |      |
| Debt                           | 2347 | 1.10  | 1.79     | 0.00 | 31.20 |
| Trade credit                   | 2347 | 0.21  | 0.18     | 0.00 | 0.97  |
| Int rate                       | 2347 | 0.03  | 0.10     | 0.00 | 0.83  |
| Fin cost                       | 2347 | 0.01  | 0.02     | 0.00 | 0.18  |
| **Panel C: Control variables** |      |       |          |      |      |
| Age                            | 2347 | 9.27  | 9.49     | 0    | 60    |
| Abidjan                        | 2347 | 0.91  | 0.29     | 0    | 1     |
| Lim liability                  | 2347 | 0.55  | 0.50     | 0    | 1     |
| Public company                 | 2347 | 0.14  | 0.34     | 0    | 1     |
| Foreign                        | 2347 | 0.28  | 0.45     | 0    | 1     |
| Agriculture                    | 2347 | 0.02  | 0.13     | 0    | 1     |
| Fishing                        | 2347 | 0.00  | 0.03     | 0    | 1     |
| Extraction                     | 2347 | 0.00  | 0.05     | 0    | 1     |
| Manufacturing                  | 2347 | 0.13  | 0.33     | 0    | 1     |
| Electricity, gaz and water     | 2347 | 0.00  | 0.04     | 0    | 1     |
| Construction                   | 2347 | 0.09  | 0.29     | 0    | 1     |
| Trade                          | 2347 | 0.33  | 0.47     | 0    | 1     |
| Hotels and restaurants         | 2347 | 0.02  | 0.15     | 0    | 1     |
| Transport and communication    | 2347 | 0.06  | 0.24     | 0    | 1     |
| Services to enterprises        | 2347 | 0.22  | 0.42     | 0    | 1     |
| Education                      | 2347 | 0.06  | 0.25     | 0    | 1     |
| Health and social              | 2347 | 0.05  | 0.21     | 0    | 1     |
| Other services                 | 2347 | 0.01  | 0.10     | 0    | 1     |

**Note:** $^a$In deflated euros (base = 2009; exchange rate 655.957 FCFA = 1 EUR).
for econometric analysis, some regions (for example, Bas-Sassandra in the South-West) that experienced fighting were unaffected according to ACLED reporting (see Figure A2 in the Supplementary Materials). Second, the variable of conflict intensity comes with one major shortcoming. The $\text{CONF}_k$ variability is rather limited due to the large number of firms operating in Abidjan (see Table 3). We are not able to obtain a more precise spatial information within Abidjan.\footnote{11}

### 4.3.3. Input usage.

A major contribution of this paper consists in scrutinizing which firms are best able to rebound. We focus on labor and access to capital. Our aim is to identify if a firm relied more on a specific input for its production before the crisis (for example, in 2009) relative to other firms in the same sector. We first describe the variables retained to characterize the

| Administrative breakdown | Nb. firms (2009, INS) | Deaths |
|--------------------------|-----------------------|--------|
| District                 | Region | Firms (2010) | % firms | NCI Abs. Rel. | ACLED Abs. Rel. |
| Abidjan                  | Adidjan | 6200 | 83.39 | 1497 | 31.82 | 453 | 9.63 |
| Yamoussoukro             | Yamoussoukro | 77 | 1.04 | 0 | 0.00 | 1 | 0.37 |
| Bas-Sassandra            | Gbôkê | 13 | 0.17 | 182 | 45.41 | 0 | 0.00 |
|                         | Nawa | 58 | 0.78 | 146 | 13.86 | 0 | 0.00 |
|                         | San-Pêdro | 186 | 2.50 | 125 | 15.12 | 0 | 0.00 |
| Comoé                    | Indénié-Djuaibling | 15 | 0.20 | 15 | 2.68 | 0 | 0.00 |
|                         | Sud-Comoé | 87 | 1.17 | 23 | 3.58 | 0 | 0.00 |
| Denguélé                 | Folon | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
|                         | Kabadougou | 3 | 0.04 | 0 | 0.00 | 0 | 0.00 |
| Gôh-Djiboua              | Gôh | 147 | 1.98 | 46 | 5.25 | 2 | 0.23 |
|                         | Lôh-Djiboua | 103 | 1.39 | 26 | 3.57 | 24 | 3.29 |
| Lacs                     | Bélier | 15 | 0.20 | 25 | 7.21 | 10 | 2.88 |
|                         | Ifou | 17 | 0.23 | 6 | 1.93 | 5 | 1.60 |
|                         | Moronou | 20 | 0.27 | 0 | 0.00 | 0 | 0.00 |
|                         | N’Zi | 31 | 0.42 | 2 | 0.81 | 0 | 0.00 |
| Lagunes                  | Agnêby-Tiassa | 79 | 1.06 | 55 | 9.06 | 0 | 0.00 |
|                         | Grands Ponts | 38 | 0.51 | 101 | 28.33 | 0 | 0.00 |
|                         | Mé | 34 | 0.46 | 49 | 9.52 | 1 | 0.19 |
| Montagnes                | Cavally | 25 | 0.34 | 289 | 62.83 | 271 | 58.92 |
|                         | Guémon | 21 | 0.28 | 385 | 41.88 | 100 | 10.88 |
|                         | Tonkpi | 7 | 0.09 | 180 | 18.13 | 26 | 2.62 |
| Sassandra-Marahoué       | Haut-Sassandra | 140 | 1.88 | 62 | 4.33 | 0 | 0.00 |
|                         | Marahoué | 5 | 0.07 | 19 | 2.20 | 0 | 0.00 |
| Savanes                  | Bagoué | 5 | 0.07 | 0 | 0.00 | 0 | 0.00 |
|                         | Poro | 23 | 0.31 | 1 | 0.13 | 0 | 0.00 |
|                         | Tchologo | 4 | 0.05 | 0 | 0.00 | 0 | 0.00 |
| Vallée du Bandama        | Gbêkê | 53 | 0.71 | 7 | 0.69 | 0 | 0.00 |
|                         | Hambol | 3 | 0.04 | 0 | 0.00 | 0 | 0.00 |
| Woroba                   | Bafing | 2 | 0.03 | 0 | 0.00 | 0 | 0.00 |
|                         | Béré | 1 | 0.01 | 0 | 0.00 | 0 | 0.00 |
|                         | Woro Dougou | 1 | 0.01 | 0 | 0.00 | 0 | 0.00 |
| Zanzan                   | Boukani | 0 | 0.00 | 5 | 1.87 | 0 | 0.00 |
|                         | Gontougo | 22 | 0.30 | 2 | 0.30 | 0 | 0.00 |
| Total                    | | 7435 | 100 | 3248 | 893 |

**Notes:** The table report the number of all firms in 2009 according to the INS dataset. We also report the percentage of firms per region (column ‘Rel.’). The last four columns display the number of deaths (Abs.) and the number of deaths per 100,000 inhabitants (Rel.) for each district using two different datasets: Data from the National Commission of the Inquiry (labelled ‘NCI’) and from the ACLED. For the latter we list the number of deaths from 1 November 2010 to 30 June 2011, as reported by the ACLED.
input mix and then describe the method employed to create a dummy indicating whether a firm relies more on a specific input than other firms in the same industry.

4.3.3.1. Variables. We firstly quantify the importance of labor in the production process by computing the cost of labor (total payroll) relative to total sales. We assume that a firm is labor intensive when the cost of labor to total sales is high.

We then consider two proxies of the composition of labor. First, we consider the share of managers (‘cadres’) to total workers. Second, we consider the average wage by dividing total wages paid by the number of total workers. The average wage is often employed to gauge the skill level of the workforce (Cole et al., 2019). Both measures increase with the importance of skilled workers in the production.

In the absence of a perfect proxy for credit access, we consider two measures of quantity and two measures of price of capital. First, we build the debt ratio by dividing the sum of (short-term and long-term) financial debt to total assets. Firms with a larger debt ratio are assumed to be less credit constrained than their counterparts (the use of equity is rather limited in Côte d’Ivoire). We also compute the ratio of trade credit to total debt (financial debt and trade credit). In line with empirical evidence (Fisman & Love, 2003), we assume that firms relying more on trade credit to finance their business are more financially constrained than are their counterparts. We also employ two proxies based on price of capital. We first compute the financial cost, defined as financial expenses to total revenue. We also calculate the implicit interest rate, computed as the ratio of financial expenses to total debt. Higher prices (financial cost and implicit interest rates) signal lower access to credit.

4.3.3.2. Computation of dummies. We focus on differences in input usage between firms within the same industry. A usual approach consists in comparing firms operating in different industries (Hallward-Driemeier & Rijkers, 2013; Klapper et al., 2013). Considering industry-level indicators implicitly assumes that all firms in the same industry face similar constraints. We raise doubts about this homogeneity assumption and its applicability in our context. First, the literature on firm productivity in developing countries sheds light on heterogeneity across firms within the same industry due to differences in access to inputs (Restuccia & Rogerson, 2017), especially during civil conflicts (Amodio & Di Maio, 2018). Second, we document in the Supplementary Materials that more than 95% of variations in input usage are explained by within-industry variations rather than by between-industry variation (Table A3).

As a result, we create input dummies that takes the value of one if a firm relies more on the input than the average in the same industry (in 2009). For quantity of labor, we create a dummy equal to one if the ratio of staff costs for firm \( i \) operating in industry \( j \) is higher than the average value in industry \( j \). For the composition of labor, we create a dummy equal to one if the share of managers (resp. the average wage) is higher than the average value in industry \( j \). For access to capital, the computation is a bit more complex. We aim to create a dummy equal to one for firms that have better access to capital in 2009. For debt ratio, the value is one for firms with a debt ratio above the industry mean, because a higher level of debt signals better access to finance. However, for the three other variables (trade credit, financial costs and implicit interest rates), a higher value signals lower credit access. As a result, the associated dummy is equal to one if the value for firm \( i \) is below the industry average for these three variables.

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In Table A2 in the Supplementary Materials, we display the mean value of each input per industry and the percentage of firms with a dummy equal to one for each input-industry pair. We therefore see that around one-third of firms have a dummy equal to one for labor (quantity and composition). For capital, the percentage of firms with a dummy equal to one is more heterogeneous. In robustness checks, we change the measure of input usage.
5. Methodology

We begin the empirical analysis by assessing the global impact of the crisis on firms. In doing so, we employ a difference-in-difference model as follows:

\[
\log(P)_{ijkt} = \alpha_i + \mu_t + \beta (POST_t \times CONF_k) + \varepsilon_{ijkt},
\]

where \(i, j, k,\) and \(t\) refer to firm, sector, region and year, respectively. \(\log(P)_{ijkt}\) denotes the logarithm of productivity (both labor productivity and total factor productivity). \(POST_t\) is a dummy taking the value of 1 for years after the occurrence of the crisis (from 2011 to 2014) and 0 before the crisis (2009 and 2010). \(CONF_k\) measures the intensity of conflict (in number of deaths per 100,000 inhabitants) in region \(k\) where firm \(i\) is located. Time and spatial dimension are controlled by the inclusion of time dummies (\(\mu_t\)) and firm fixed effects (\(\alpha_i\)).\(^{14}\) The global impact of the crisis on firms is given by \(\beta\).

We then focus on how initial firm characteristics influence recovery. We extend Eq. 1 by adding an interaction between firm attributes and the measure of conflict exposure as follows:

\[
\log(P)_{ijkt} = \alpha_i + \mu_t + \beta_1 (POST_t \times CONF_k) + \beta_2 (POST_t \times CONF_k) \times X_{ij(t_0)} + \varepsilon_{ijkt}
\]

The measure of conflict exposure (\(POST_t \times CONF_k\)) is interacted with initial firm attributes (\(X_{ij(t_0)}\)). Firm variables include not only input usage dummies (described above) but also usual firm characteristics: size (in terms of assets and workers, both in logarithm form), age, a dummy for foreign-owned firms, a dummy for firms located in Abidjan and a dummy for each industry. All firm variables are measured in 2009, that is, before the crisis (\(t_0\)).

We finally disentangle the impact of the crisis (2011) and the post-crisis periods (2012–2014) to scrutinize whether input mix before the crisis has differently affected both phases and estimate the following equation:

\[
\log(P)_{ijkt} = \alpha_i + \mu_t + \delta_1 (CRISIS_t \times CONF_k) + \delta_2 (CRISIS_t \times CONF_k) \times X_{ij(t_0)} + \gamma_1 (POSTCR_t \times CONF_k) + \gamma_2 (POSTCR_t \times CONF_k) \times X_{ij(t_0)} + \varepsilon_{ijkt}
\]

where \(CRISIS_t\) is a dummy for year 2011 and \(POSTCR_t\) is a dummy taking the value of one for years 2012 to 2014 (other variables are defined above).

Expected coefficients (\(\beta_2, \delta_2,\) and \(\gamma_2\)) according to theoretical framework are given in Table 1 in Section 3.

The empirical strategy exploits three levels of variation: time (before/after the crisis), location (regions with different exposure to conflict) and production process (input mix before the crisis). We control for time and spatial dimensions by including year dummies and firm fixed effects in all equations. Our identification strategy therefore requires that we control for all characteristics affecting both input usage before the crisis and a firm’s ability to rebound after a shock. Observed (such as size) and unobserved (such as level of entrepreneur skills) firm characteristics may not only influence resilience but also the input mix before the crisis. For instance, firms managed by a dynamic manager (or older firms) are more likely both to get formal loans and to be able to cope with a crisis. This point explains why we add interactions between crisis exposure and firm characteristics (age, size, ownership, etc.) as well as firm fixed effects (controlling for a firm’s time-invariant characteristics). The empirical approach here does not allow us to include unobserved time varying unmeasured variables (such as change in organization). However, we argue that this issue does not disqualify the analysis.\(^{15}\) Finally, we provide the evidence in robustness section that sample selection issue, induced by the fact that we consider only surviving firms, do not bias findings.
6. Results

6.1. The global impact of the crisis

We begin by presenting descriptive statistics. Table 4 presents the evolution of labor productivity and its components (value-added and workers) for surviving firms from 2009 to 2014, by year. We see an increase from 2009 to 2010 of labor productivity and its components (value-added and number of workers). However, labor productivity, as well as value-added and the number of workers, decreased in 2011. The impact of the crisis was significant for labor productivity, which shrank by 23%. The recovery in terms of productivity is imperfect. Even if, on average, the level of labor productivity in 2014 is superior to that in 2009, it has not attained the 2010 level. Meanwhile, the impact of the civil conflict on value-added (Panel B) and the number of workers (Panel C) is temporary (1 year for value added and 2 years for employment).

We then provide more direct evidence by running the sample difference-in-difference model displayed in Eq. 1. Main estimation results are displayed in Figure 2 (associated table is displayed in Panel A of Table A4 in the Supplementary Materials). We begin by including only the pre-crisis period (2009–2010) and crisis year (2011) to evaluate the short-term effect of the crisis (circle). We then add 2012 (square) to evaluate how firms rebound after 1 year. We continue by adding 2013 (triangle) and 2014 (diamond) to assess whether firms bounce back over time. To assess the economic impact of the crisis, we point out that we rely on a continuous measure of conflict intensity. On average, districts that experienced battles had 27 deaths per 100,000 inhabitants. By using this value, we observe an 18% decrease of labor productivity in 2011 (0.0065/C3 27). When we include the next year, around half of the losses are recouped. However, we do not see any improvement after one year. These econometric results are in line with the raw statistics provided in Table 4.16

In Panel B of Table A4 (Supplementary Materials), we consider the total factor productivity. As indicated at the bottom of Table A4, the number of observations sharply decreases. The decline of TFP is rather high in 2011 (−18%) but even sharper in the following year. Three years after the end of the crisis, on average, TFP is 35% lower than before the crisis.

Table 4. Evolution of firm size and productivity

| Year   | Mean   | 1st quartile | Median  | 3rd quartile |
|--------|--------|--------------|---------|--------------|
| Panel A: Labor productivity (in euros, deflated) |
| 2009   | 9 280.6 | 811.8        | 3 517.6 | 7 645.4      |
| 2010   | 11 577.6| 1 099.4      | 3 885.9 | 8 762.8      |
| 2011   | 8 851.1 | 645.9        | 2 998.5 | 7 021.1      |
| 2012   | 8 177.8 | 1 257.6      | 3 759.4 | 8 312.6      |
| 2013   | 9 449.4 | 1 209.4      | 3 308.1 | 7 088.6      |
| 2014   | 9 304.3 | 1 177.7      | 3 754.5 | 7 931.9      |
| Panel B: Value added (in euros, deflated) |
| 2009   | 122 663 | 4 192        | 28 964  | 98 133       |
| 2010   | 137 860 | 5 817        | 33 509  | 114 381      |
| 2011   | 120 679 | 3 091        | 24 735  | 91 791       |
| 2012   | 140 051 | 6 373        | 34 455  | 120 268      |
| 2013   | 157 997 | 6 995        | 34 891  | 131 822      |
| 2014   | 165 872 | 5 252        | 35 916  | 129 702      |
| Panel C: Number of total workers |
| 2009   | 15.05   | 4            | 7       | 18           |
| 2010   | 26.31   | 4            | 8       | 19           |
| 2011   | 19.19   | 4            | 8       | 19           |
| 2012   | 19.05   | 4            | 8       | 21           |
| 2013   | 36.49   | 4            | 9       | 26           |
| 2014   | 22.26   | 4            | 9       | 22           |
Finally, we examine the change of the component of labor productivity (see Table A4, Panels C and D). The difference in evolution between value added and the number of workers explains the negative trend on labor productivity. The negative impact of the crisis on value added is temporary, as documented in Panel C. Surprisingly, the crisis has positively affected the number of workers (Panel D). One explanation, explored below, is that skill-intensive firms substitute skilled workers with unskilled workers during the crisis, driven by the average impact of the crisis on employment. We document that our findings are largely robust to the use of growth (columns 5–8 of Table A4) instead of level for all variables.

To summarize, findings on the global impact of the post-electoral crisis indicate that it has a profound and permanent impact on productivity (labor productivity or TFP even if figures diverge). In terms of labor productivity, the decline is rather explained by a contraction of wealth creation (job creation has been less affected by the crisis).

6.2. Firm characteristics

While the crux of the paper is about input reliance and recovery, it is interesting to first document the impact of other firm characteristics on recovery. We present full results (including interactions with firm characteristics) in Table A5 (labor productivity) and Table A6 (total factor productivity) in the Supplementary Materials. Despite differences in period coverage, our findings are very similar to those obtained by Klapper et al. (2013) regarding the first Ivorian crisis. First, we see that foreign firms suffer more than their local counterparts do. Foreign firms that are more externally oriented and are more sensitive to disturbances in infrastructure and logistics chains.

Second, in theory, the impact of firm size and age is ambiguous. Our findings indicate that large firms, measured by the number of workers, suffer more than small ones, in line with econometric results produced by Klapper et al. (2013). Turning to firm age and location, our results fail to find it has a clear impact on recovery. Finally, we see that there is a limited difference in impact across industries. Firms in the trade sector suffer more during and after the crisis. On the opposite side of the spectrum, firms operating in tourism and education suffer less than firms in other sectors (although the net impact remains negative). It should be noted that
the impact on other industries (extraction, fishing) is not robust when we consider total factor productivity (see Table A6).

6.3. Labor and firm recovery

6.3.1. Quantity of labor. We study whether the dependence on labor before the crisis impacts a firm’s ability to rebound after the crisis. In Panel A of Table 5, we run Eq. 2. In Panel B of the same table, we break down the impact during the crisis and post-crisis periods as indicated in Eq. 3. We display results using the logarithm of labor productivity (LP) and of total factor productivity (TFP).

In columns (1) and (2) we analyze the impact of the quantity of labor in a firm’s production process. As indicated in Table 1, we expect the overall impact of the crisis to be null or positive. Econometric results displayed in Panel A of Table 5 confirm Hypothesis 1. Firms that relied more on labor before the crisis (irrespective of workforce composition) are more resilient, as indicated in the models using LP (column 1) and TFP (column 2). To get a sense of our estimation, at the bottom of Panel A, we compute the impact of the post-crisis interaction on firms with a labor-intensive production process (dummy equal to one). We show that these companies have experienced an increase of productivity 3 years after the crisis. In the Supplementary Materials, we scrutinize how reliance on labor affects the two components of labor productivity (Table A7). Results indicate that firms with higher staffing costs have increased their productivity after the crisis because they have experienced an increase of value added and a contraction of employment.

Firms that use a large share of labor in the production process are expected to perform differently during and after the crisis (Hypothesis 1). In Panel B of Table 5, we distinguish the crisis and post-crisis years by running Eq. 3. The first two columns show that labor intensive firms suffered less than other firms during the crisis (in 2011), as well as in the post-crisis period. The result for the post-crisis period is as expected (see Hypothesis 1). However, contrary to expectations, labor-intensive firms also suffered less during the crisis year (in 2011). One possible explanation is the fact that our analysis employs annual observations. If labor-intensive firms are able to rebound in a few weeks, we cannot perceive the short-term negative impact by exploiting only yearly observations, because the shock occurred in the first semester of 2011.

6.3.2. Workforce composition. We then turn to workforce composition. As indicated in Hypothesis 2, we expect a negative impact of the crisis over the medium term for firms that employ a large share of key workers (skilled workers or managers). Results in Panel A of Table 5, indicate that the composition of the workforce helps to explain why some firms are more able to bounce back than others. Firms that rely more on managers (columns 3–4) and that have a greater share of skilled workers (columns 5–6) suffer more than other firms in the same industry after 3 years. Table A7 in the Supplementary Materials breakdown the effect of the post-crisis period on value-added and the number of workers. We see an increase in the number of workers of firms that rely ex ante on managers and/or skilled labor. Meanwhile, the value added grew more slowly (managers) or decreased (average wage). One possible explanation is that skill-intensive firms tried to hire more employees to compensate for the loss of key workers without restoring the previous level of value added, perhaps because the new employees have fewer skills or because it takes time for these new workers to get up to speed and become productive (learning-by-doing). To test this possible explanation, we run additional regressions in the Supplementary Materials (Tables A8–A9). We document that skill-intensive firms continued to hire workers, despite a contraction of value-added, but these employees were paid less (less skilled workers) and were more likely to be non-managers.

In Panel B of Table 5 (columns 3 to 6), we distinguish between the impact of the workforce composition on the crisis and post-crisis periods by running Eq. 3. Findings are in line with...
Table 5. Labor and firm recovery

| Input | Staff cost | Managers | Average wage |
|-------|------------|----------|--------------|
|       | Log(LP) | Log(TFP) | Log(LP) | Log(TFP) | Log(LP) | Log(TFP) |
| (1)   | (2)     | (3)     | (4)     | (5)     | (6)     |

Panel A: Net effect of the crisis

| (POST x CONF) | Log(LP) | Log(TFP) | Log(LP) | Log(TFP) | Log(LP) | Log(TFP) |
|---------------|---------|----------|---------|----------|---------|----------|
|               | -0.188** | -0.101** | -0.191** | -0.094** | -0.216** | -0.115** |
|               | (0.010)  | (0.015)  | (0.010)  | (0.016)  | (0.011)  | (0.017)  |
| (POST x CONF) x Input | 0.503** | 0.408** | -0.122** | -0.079 | -0.322** | -0.235** |
|               | (0.040)  | (0.050)  | (0.040)  | (0.057)  | (0.037)  | (0.052)  |
| Combined effect | 0.315** | 0.307** | -0.313** | -0.173** | -0.358** | -0.350** |
| Obs.          | 11,178  | 4640     | 11,178  | 4640     | 11,178  | 4640     |
| Firms         | 2347    | 2088     | 2347    | 2088     | 2347    | 2088     |
| R² (within)   | 0.202   | 0.161    | 0.179   | 0.139    | 0.187   | 0.146    |

Panel B: Distinction between crisis and post-crisis periods

| (CRISIS x CONF) | Log(LP) | Log(TFP) | Log(LP) | Log(TFP) | Log(LP) | Log(TFP) |
|-----------------|---------|----------|---------|----------|---------|----------|
|                 | -0.183** | -0.144** | -0.184** | -0.139** | -0.199** | -0.165** |
|                 | (0.014)  | (0.020)  | (0.015)  | (0.021)  | (0.015)  | (0.022)  |
| (CRISIS x CONF) x Input | 0.524** | 0.382** | -0.119* | -0.052 | -0.222** | -0.269** |
|                 | (0.061)  | (0.061)  | (0.052)  | (0.073)  | (0.047)  | (0.063)  |
| (POSTCR x CONF) | -0.179** | -0.102** | -0.183** | -0.096** | -0.210** | -0.118** |
|                 | (0.017)  | (0.011)  | (0.011)  | (0.017)  | (0.012)  | (0.019)  |
| (POSTCR x CONF) x Input | 0.493** | 0.412** | -0.127** | -0.092 | -0.338** | -0.249** |
|                 | (0.055)  | (0.055)  | (0.042)  | (0.061)  | (0.039)  | (0.056)  |
| Obs.            | 2347    | 2088     | 2347    | 2088     | 2347    | 2088     |
| Firms           | 11,178  | 4640     | 11,178  | 4640     | 11,178  | 4640     |
| R² (within)     | 0.208   | 0.189    | 0.185   | 0.167    | 0.193   | 0.175    |

Notes: The dependent variable is the logarithm of labor productivity in columns (1), (3) and (5) and the logarithm of total factor productivity in columns (2), (4), and (6). Panel A reports results from estimations assessing the global impact of the crisis and post-crisis period as provided in Eq. 2. POST is a variable equal to zero before the crisis (for example, 2011) and equal to one after 2011. Combined effect measures the point estimates for firms with an input dummy equal to one (and associated statistical significance). Panel B displays results from estimations distinguishing between crisis and post-crisis periods, as indicated in Eq. 3. CRISIS is a dummy taking value of one in 2011 and zero otherwise. POSTCR is a dummy taking the value of one in 2012, 2013 and 2014 and zero otherwise. CONF is the number of deaths per 100,000 inhabitants in the region. Interactions with firm characteristics are included but unreported (full tables are provided in the Supplementary Materials). A within estimator (firm fixed effect) is used. In each column, we refer to an interaction with an input dummy. We consider three dummies related to reliance on labor. In columns (1) and (2), we create a dummy equal to one if a firm employ more labor than other firms in the same industry. In columns (3) and (4), the dummy equals one if the share of managers is higher than the industry mean. In the last columns, the dummy is one if the average wage is higher than the mean of average in the industry. Firm fixed effect as well as control interactions, are included but unreported. Standard errors are clustered at the firm-level. * and ** signal significance at the 5% and 1% levels, respectively.
Hypothesis 2: skill-intensive firms not only suffer more during the crisis but are also less able to bounce back afterwards.

6.4. Access to capital and firm recovery

Finally, we investigate how financial constraint affects firm dynamics during the Ivorian post-electoral crisis in Table 6. We employ four measures, both of quantity and of price. We compute each variable to take value of one for firms with better access to credit than the average company in the same industry. Results displayed in Panel A show that firms with better access to finance face a lower decline in productivity, irrespective of the measure of either credit access or productivity retained. Coefficients associated to the triple interaction are positive in all specifications (with one exception) and statistically significant at the usual thresholds in 6 out of 8 specifications. At the bottom of Panel A we document that firms with access to credit before the crisis experienced no change in productivity after 3 years. Interestingly, results displayed in the Supplementary Materials (Table A7), indicate that firms with better access to credit perform better during the crisis, in terms of both value-added and employment.

Panel B of Table 6 scrutinizes the impact of the crisis and post-crisis years for firms according to their level of credit constraints. Econometric results, displayed in Panel B of Table 6, confirm Hypothesis 3. We document that access to finance is crucial during the post-crisis period, but less important during the crisis itself. Credit-constrained firms do not suffer more than unconstrained ones during the fighting but are less able to rebound when the crisis is over. This finding is consistent with the fact that banks closed during the crisis in Côte d’Ivoire, particularly in Abidjan. As a result, firms with access to credit before the crisis experienced no change in productivity after 3 years. Interestingly, results displayed in the Supplementary Materials (Table A7), indicate that firms with better access to credit perform better during the crisis, in terms of both value-added and employment.

6.5. Discussion

To summarize, findings indicate that the production process before the crisis plays a crucial role in understanding how firms bounce back afterwards. We point out that there is a strong heterogeneity in recovery, which is explained by the initial input mix. Firms with better access to credit and those with a production process that relies more on low skilled labor are more able to bounce back. In contrast, firms that rely on skilled workers and managers suffer more. These findings are in line with results provided by Amodio & Di Maio (2018), which state that conflicts introduce distortions related to access to inputs. The authors document that during the Second Intifada, Palestinian businesses more exposed to conflicts substitute domestically produced materials for imported inputs. According to the authors’ calculations, 70% of the drop in the outputs is due to these distortions in the access of foreign markets of firms that operated in affected areas. In line with this paper, we show that conflicts affect the accessibility of some inputs not only during the violence but also afterwards. It should be noted that results regarding labor are in line with previous findings in other contexts (Collier & Duponchel, 2013; Jola-Sanchez & Serpa, 2021). The role of access to capital, especially after a crisis, is less well-documented in the context of conflicts, but there is some evidence related to other shocks as natural disasters (De Mel et al., 2012; Elliott et al., 2019). The absence of impact of access to credit during the fighting can be due to a specificity of Côte d’Ivoire (closure of banks) but may also be a general pattern if banks cannot operate normally during armed conflicts.

6.6. Sensitivity analysis

6.6.1. Robustness checks. We run a battery of sensitivity tests to confirm the main results described above. For the sake of brevity, we focus on models based on Eq. 2, mixing crisis and
| Input | Debt ratio | Trade credit | Financial costs | Implicit interest rates |
|-------|------------|--------------|-----------------|------------------------|
|       | Log(LP) (1) | Log(TFP) (2) | Log(LP) (3)      | Log(TFP) (4)           | Log(LP) (5) | Log(TFP) (6) | Log(LP) (7) | Log(TFP) (8) |
| POST x CONF | -0.182** | -0.087** | -0.191** | -0.095** | -0.186** | -0.082** | -0.191** | -0.092** |
|         | (0.010)   | (0.015)   | (0.010) | (0.016) | (0.010) | (0.015) | (0.010) | (0.015) |
| (POST x CONF) x Input | 0.142** | 0.130* | 0.100** | 0.084+ | 0.006 | 0.150** | 0.096* | -0.041 |
|         | (0.045)   | (0.062)   | (0.037) | (0.047) | (0.041) | (0.049) | (0.040) | (0.048) |
| Combined effect | -0.040 | 0.043 | -0.091 | 0.011 | -0.179* | 0.068 | -0.095* | 0.133 |
| Obs. | 11,178 | 4640 | 11,178 | 4640 | 11,178 | 4640 | 11,178 | 4640 |
| Firms | 2347 | 2088 | 2347 | 2088 | 2347 | 2088 | 2347 | 2088 |
| R² (within) | 0.179 | 0.140 | 0.179 | 0.139 | 0.178 | 0.141 | 0.178 | 0.138 |

Panel A: Net effect of the crisis

Panel B: Distinction between crisis and post-crisis periods

Notes: The dependent variable is the logarithm of labor productivity in columns (1), (3) and (5) and the logarithm of total factor productivity in columns (2), (4), and (6). Panel A reports results from estimations assessing the global impact of the crisis and post-crisis periods, as provided in Eq. 2. POST is a variable equal to zero before the crisis (for example, 2011) and equal to one after 2011. Combined effect measures the point estimates for firms with input dummy equal to one (and associated statistical significance). Panel B displays results from estimations distinguishing between crisis and post-crisis periods, as indicated in Eq. 3. CRISIS is a dummy taken value one in 2011 and zero otherwise. POSTCR is a dummy taking the value of one in 2012, 2013 and 2014 and zero otherwise. CONF is the number of deaths per 100,000 inhabitants in the region. Interactions with firm’s characteristics are included but unreported (full tables are provided in the Supplementary Materials). Within estimator (firm fixed effect) is used. In each column, we refer to an interaction with an input dummy based on two quantity measures (debt ratio and the share of trade credit) and two prices measures (financial cost and implicit interest rate). All dummies takes value one if a firm has a better access to credit than other firms in the same industry. Firm fixed effect as well as control interactions are included but unreported. Standard errors are clustered at the firm-level. +, * and ** signal significance at the 10%, 5% and 1% levels, respectively.
post-crisis periods and testing for labor productivity.\textsuperscript{18} Tables for all robustness checks are reported in the Supplementary Materials (Tables A10--A14).

First, we exploit both time and spatial exposition to conflict in the baseline analysis. However, the majority of firms are located in Abidjan and these firms can drive econometric results. We therefore provide two robustness checks in Table A10 to assess whether our findings are not only due to firms in Abidjan. First, we keep only firms outside Abidjan. Econometric results are closely similar as indicated in Panel A, despite a sharp reduction in the number of observations. We should note, however, that coefficients associated with capital access have the same sign as in the baseline analysis but are not statistically significant. One possible explanation is that access to formal finance is limited outside of Abidjan due to a limited number of bank branches. Second, in Panel B, we employ model with observations weighted by the number of firms in the municipality. In other words, we put the same weight for all cities and econometric results are unchanged.

Second, we test whether our findings are sensitive to the measure of performances in Table A11. We change the definition of labor productivity by using an alternative definition of workforce (in Panels A and B). We then consider measures based on accounting outcomes: the logarithm of profit before taxes (Panel C), the ratio to gross operating surplus divided by sales (Panel D), and the return on assets (Panel E). Our findings are largely unaffected.

Third, we play with the measurement of input usage and the timing of the crisis in Table A12. We create a dummy based on the median in the industry rather than the mean (Panel A), and we consider continuous measures instead of dummies (Panel B). These changes do not alter the main findings. In the rest of Table A12 we change the definition of the pre-crisis and crisis periods. We include 2008 in the pre-crisis period (Panel C) and we include 2010 in the crisis period (Panel D) without noticing significant differences in the results. We then extend run a placebo test. We consider the years 2007 to 2009 and create a $POST_t$ dummy equal to one in 2009 (and zero otherwise). We expect that input mix will not affect productivity before the crisis as confirmed in Panel E.

Fourth, we exploit alternative sources of data and different measures to proxy the intensity of the conflict in Table A13. In panel A, we determine the number of deaths per 100,000 inhabitants from the ACLED, an alternative source of data, to compute the $CONF$ variable. In Panels B and C, we consider the absolute number of deaths (instead of the relative number to the population) using NCI and ACLED data, respectively. In Panel D, we consider the number of events instead of the number of deaths as another proxy of conflict intensity (we employ the ACLED because the NCI only gives the number of deaths). Finally, in Panels E and F, we create dummy variables instead of continuous measures of conflict intensity to discriminate between affected and non-affected firms (using both NCI and ACLED data). The main findings are unaltered by these changes.

Finally, we address remaining econometric issues in Table A14. In the baseline, we exclude firms with a negative value of labor productivity (because we employ a logarithm function). We document that our findings are not altered by this choice of using the value of productivity instead of the log (in Panel A) and by employing a hyperbolic sine transformation of labor productivity in Panel B.\textsuperscript{19} On the other hand, the baseline specification suffers from a sample selection issue because we exclude non-surviving firms from 2009 to 2014. To control this issue, we rely on two approaches. First, we follow De Mel et al. (2019) and set the value of productivity to zero for firms that exit during the period, shown in Panel C.\textsuperscript{20} Second, we develop a selection model for fixed effects panel data. We employ the three-step procedure proposed by Wooldridge (1995) and already implemented by Baraton and Léon (2021). Details about the method are reported in the Supplementary Materials. This method is far from perfect because we cannot identify a proper selection variable and econometric results are potentially sensitive to specification. Nonetheless, despite the limitations of this approach, we do not find a change in our main findings.\textsuperscript{21}
Table 7. Heterogenous across firms

| Input → | Staff | Manager | Avg wage | Debt | Trade C. | FinCost | IntRate |
|-------------------|------|---------|----------|------|---------|---------|---------|
| POST × CONF       |      |         |          |      |         |         |         |
| (POST × CONF) × Input |      | 0.043   | 0.043    | 0.040 | 0.050   | 0.041   | 0.044   |
| (POST × CONF) × Input × Foreign |      | 0.068   | 0.083    | 0.066 | 0.091   | 0.073   | 0.080   |
| Obs.              | 11,178 | 11,178  | 11,178   | 11,178| 11,178  | 11,178  | 11,178  |
| # Firms           | 2,347  | 2,347   | 2,347    | 2,347 | 2,347   | 2,347   | 2,347   |
| R² (within)       | 0.20   | 0.18    | 0.19     | 0.18  | 0.18    | 0.18    | 0.18    |

Panel A: Foreign firms vs. Local firms

| (POST × CONF) × Input |      | 0.043   | 0.043    | 0.040 | 0.050   | 0.041   | 0.044   |
| (POST × CONF) × Input × Foreign |      | 0.068   | 0.083    | 0.066 | 0.091   | 0.073   | 0.080   |
| Obs.              | 11,178 | 11,178  | 11,178   | 11,178| 11,178  | 11,178  | 11,178  |
| # Firms           | 2,347  | 2,347   | 2,347    | 2,347 | 2,347   | 2,347   | 2,347   |
| R² (within)       | 0.20   | 0.18    | 0.19     | 0.18  | 0.18    | 0.18    | 0.18    |

Panel B: Young firms vs. Old firms

| (POST × CONF) × Input |      | 0.044   | 0.047    | 0.046 | 0.050   | 0.047   | 0.048   |
| (POST × CONF) × Input × Young |      | 0.053   | 0.087    | 0.057 | 0.056   | 0.062   | 0.055   |
| Obs.              | 11,178 | 11,178  | 11,178   | 11,178| 11,178  | 11,178  | 11,178  |
| # Firms           | 2,347  | 2,347   | 2,347    | 2,347 | 2,347   | 2,347   | 2,347   |
| R² (within)       | 0.20   | 0.18    | 0.19     | 0.18  | 0.18    | 0.18    | 0.18    |

Panel C: Small firms vs. large firms

| (POST × CONF) × Input |      | 0.044   | 0.043    | 0.041 | 0.049   | 0.042   | 0.044   |
| (POST × CONF) × Input × Small |      | 0.050   | 0.049    | 0.051 | 0.051   | 0.055   | 0.049   |
| Obs.              | 11,178 | 11,178  | 11,178   | 11,178| 11,178  | 11,178  | 11,178  |
| # Firms           | 2,347  | 2,347   | 2,347    | 2,347 | 2,347   | 2,347   | 2,347   |
| R² (within)       | 0.22   | 0.20    | 0.21     | 0.20  | 0.20    | 0.20    | 0.20    |

Notes: The dependent variable is the logarithm of labor productivity. POST is a variable equal to zero before the crisis (for example, 2011) and equal to one after 2011. CONF is the number of deaths per 100,000 inhabitants in the region. Interactions with firm characteristics are included but unreported. A within estimator (firm fixed effect) is used. In each column, we refer to an interaction with an input dummy. We consider three dummies related to reliance on labor. In columns (1) and (2), we create a dummy equal to one if a firm employ more labor than other firms in the same industry. In columns (3) and (4), the dummy equals one if the share of managers is higher than the industry mean. In the last columns, the dummy is one if the average wage is higher than the mean of average in the industry. Firm fixed effect as well as control interactions, are included but unreported. *, ** and *** signal significance at the 10%, 5% and 1% levels, respectively.
6.6.2. Heterogeneity across firms. Finally, in Table 7, we investigate whether the relationship between the initial input usage and recovery differs by type of firms. A shortage of a specific input may disproportionately affect some firms which initially faced frictions in the access to these inputs. In particular, we expect that opaque (small and young) firms initially suffered from difficulty in access to capital. A crisis could reinforce this obstacle if banks tighten credit conditions after the crisis and favor well-established enterprises.

We classify firms according to three criteria: (i) ownership structure (foreign-owned vs. domestic-owned firms) in Panel A, (ii) age in Panel B, and (iii) size in Panel C. We rerun baseline models from Eq. 1 with an interaction between \((POST \times CONF) \times Input\) and a dummy variable for each category.22

Panels A and B of Table 7 indicate that neither foreign ownership nor age matter. The former result is interesting because it tends to reject the hypothesis that findings are driven by a demand channel. In particular, this missing demand channel could explain the relationship between workforce composition and recovery. Labor-intensive firms may sell their products in local markets, contrary to skill-intensive firms that are more dependent on national or international markets. As a result, the impact of labor could be due to limited access to markets. Due to lack of data (for example, export status), we cannot directly test this hypothesis. However, we expect that foreign-owned firms are more oriented towards international markets. According to this explanation, we should see that the importance of workforce composition on a firm’s ability to recover will be higher for foreign-owned. Findings displayed in Panel A reject this assumption.

We point out that small firms differ from large firms in Panel C. Among labor-intensive firms, small firms rebound stronger than large firms do. In columns (2) and (3), we also document that labor composition has a differential impact between small and large firms. Large firms relying on skilled workers or managers tend to suffer more than small firms with the same characteristics. One possible explanation is that small firms need to hire a few workers, while large firms have to recruit more employees, even if they are able to attract more talents. Furthermore, it takes more time in large companies to re-organize production, especially in complex structure (with more managers/skilled workers). Finally, we find that small firms suffer more from a lack of access to bank credit. This finding is in line with the idea that large firms are often less credit-constrained by banks because they are able to produce hard information (Beck & Cull, 2014).

7. Conclusion

This paper examines how firms bounce back after a short, albeit severe, episode of political violence and unrest. While a large body of literature has shown that conflicts disrupt business activity in the short-run, we know little about the persistent, subsequent impact of crises on companies. Better understanding factors that spur or mitigate firm recovery is of prime interest in formulating effective post-conflict policies. This paper fills this gap by examining firm rebound after the 2011 post-electoral crisis in Côte d’Ivoire.

To investigate firm recovery, we follow a cohort of (surviving) small and medium enterprises from 2009 to 2014. We focus on initial conditions to explain differences in recovery, especially the input mix employed by firms prior to the crisis.

This paper provides three important findings. First, on average, firms only partially recover. While we see a rapid rebound in the year following the crisis, we do not observe major improvement afterwards. On average, after 3 years, firms have been able to recoup only half of their losses. In other words, even limited events have persistent effects on firm dynamics in a context of high instability. We therefore confirm macroeconomic studies highlighting that wars have a persistent effect on economic activity (Cerra & Saxena, 2008; Mueller et al., 2017; Novta and Pugacheva, 2021).
Second, the relationship between labor and recovery is complex and depends on a company’s workforce composition. While all firms experience worker defections during a civil war, the implications of a negative supply-side labor shock differ according to the firm’s workforce composition. In particular, replacement of key workers (engineers, managers) takes time to materialize in terms of productivity. Even if companies are able to re-hire or re-instate skilled workers, their skills may have depreciated due to inactivity over several months (Edin & Gustavsson, 2008) or skilled workers may need complementary factors that are lacking (for example, computers or other skilled workers). Sometimes, a company’s key workers, especially if they are foreigners, never return.

Third, firms with better access to credit are more resilient. This result indicates that finance is not only crucial for business in normal times but also for firm resilience after a shock, in line with papers focusing on other shocks (Berg & Schrader, 2012; Bolton et al., 2016). Our paper’s findings, together with previous studies in different contexts, provide interesting insights for policymakers. These works highlight that the consequences of a conflict are heterogeneous across firms and that some companies are more vulnerable due to their production process. Our results signal that particular attention should be dedicated to re-composition of human capital following a shock. While it would seem complex to limit workforce flight in the midst of a war, policymakers could facilitate the return of skilled workers by using different tools at their disposal (from tax incentives to direct interventions). Second, improving access to funds for credit-rationed firms may help them to recover. This could be done by strengthening and supporting private lenders, mobilizing external funds (aid and remittances) or developing direct public supports.

This study suffers from some limitations that offer pathways for future works. First, we do not investigate the impact of a crisis on firm exit because it is beyond the scope of this study. However, initial results document that input usage, if it influences recovery, does not seem to affect exit (see table D1 in the Supplementary Materials). Nonetheless, a few works have investigated the question of exit during a conflict (Camacho & Rodriguez, 2013). Second, we only have data on formal firms while many firms in Côte d’Ivoire are informal. The impact of conflict on informal firms and on migration towards informality is largely unknown (one exception is Bozzoli et al., 2013). Finally, our findings regarding supply channel are in line with previous papers on civil conflicts. It could be interesting to scrutinize whether supply, demand and uncertainty channels are relevant for recovery in the event of other shocks. While there is an emerging literature on the impact of natural disasters (Cole et al., 2019; De Mel et al., 2012; Elliott et al., 2019) and health shocks (Bowles et al., 2016) on firms; these works, however, rarely focus on recovery.

Notes

1. Even strong physical destruction may have limited long-term impact, as documented in the literature on the impact of bombing (Davis & Weinstein, 2002; Miguel & Roland, 2011). Evidence from the literature on the consequences of natural disasters also show that local events have a limited impact on global activity in the long-run (Cole et al., 2019; Elliott et al., 2019).
2. As explained in Section 2, the election occurred in the end of 2010 and the post-electoral crisis began at the very end of 2010 (see Figure A1 in the Supplementary Materials). However, it largely materialized in 2011, so we label it as the 2011-post electoral crisis, the period of which is more in line with our empirical analysis.
3. Until recently, the literature on the economic consequences of political violence has been dominated by cross-country analyses (Alesina, Özler, Roubini, & Swagel, 1996; Cerra & Saxena, 2008). Research employing firm-level data has employed market valuation and documents that consequences of conflict are heterogeneous (Abadie & Gardeazabal, 2003; Guidolin & La Ferrara, 2007). However, these studies focus exclusively on listed firms and neglect the large majority of firms in developing countries.
4. Finishing third in the first round, Henri Konan Bédié endorsed Ouattara for the second round. Alassane Ouattara was the former prime minister under the Presidency of Houphouët Boigny. He was disqualified from the 2000 presidential election due to the new electoral code stating that both parents must be Ivorian to run.
Theoretically, the negative impact of violence may transit through three main channels: (i) supply channel (availability and cost of inputs); (ii) demand channel (contraction of demand, access to output markets); and, (iii) uncertainty (inducing firms to postpone hiring and investment decisions and adopt risk mitigation strategies). These three channels may explain why some firms are more able to rebound than others. In line with recent papers, we also focus on the supply channel, especially because we lack the necessary data to test the other two channels.

In a previous analysis, we also consider intermediate goods by computing their cost (difference between sales and value-added) to sales. However, results are highly unstable and do not allow us to draw a clear-cut conclusion.

Before 2008, formal firms in Côte d’Ivoire transmitted their financial statements to both fiscal authorities (mandatory) and to the INS (not mandatory). As a result, some firms were registered with the fiscal authorities but not included in the INS dataset. In 2008, a single window was created to facilitate the transmission of data. Since 2010, the INS has begun to cooperate with the new institution to retrieve data on all formal firms.

A simple observation of entries indicates that some entries defined as real entries are subject to caution. For instance, some new firms entered with more than 100 employees.

In 2012 an administrative order was adopted to facilitate the creation of new firms through a ‘guichet unique’ (Centre de Promotion des Investissement en Côte d’Ivoire) and a reduction in the number of procedures (Article 4 of order number 2012–867, 6 September 2012). As a result, we fail to disentangle the impact of the end of the post-electoral crisis and from the impact of the 2012 law in explaining the sharp increase in the number of entries after 2012.

The number of inhabitants in each district is obtained from the 2014 population census. Ideally, we would use data on population prior to the crisis. However, the previous population census in 2010 was based on a different administrative breakdown (departement). Unfortunately, some departements are in different regions and we cannot re-calculate population per region using this information. We therefore exploit data for 2014, where population data is provided by regions as NCI data.

The location of firms as well as of conflicts (in ACLED) are provided at the city level. However, we do not have more granular within-city information.

One might raise concerns that average wage is correlated with (labor) productivity but across-firm correlation is far from perfect ($\rho = 0.36$). In addition, in unreported robustness checks, we run dynamic panel model (including lagged productivity) and findings are unchanged.

To quantify the importance of within-industry and between-industry variations in the use of input, we regress different measures of input usage on industry dummies. We consider several specification including all observations available in the database and only firms included in our sample (all years or only in 2009). Results are insensitive to different specifications, as indicated in Table A3. Industry dummies capture variation between industries, while the unexpected part refers to within-industry variations. Industry dummies explain less than 5% of variations in input usage, except for cost of labor to sales (8%). It should be noted that firm characteristics (age, size, location and foreign-ownership) have a limited explanatory power of input usage, except for average wage (the four variables explain 13% of variations).

We use the initial location of the firm, so firm fixed effects account for location. Indeed, as explained below, all firm-level characteristics are measured before the crisis (see below) and are therefore time-invariant (and perfectly collinear with firm fixed effects).

To bias our findings, unobserved factors should not only be related to recovery but also correlated with input usage in 2009.

We first decompose firms into two groups: treated and control. We define treated firms as those in regions with more than 10 deaths per 100,000 inhabitants. After discriminating between treated and untreated firms, we rely on two usual tests implemented in the literature to test pre-trend. We first consider an event-study model with lags and leads. The model is as follows: $\log(P_{ijk}) = \alpha_i + \mu_t + \beta_1TREATED_k + \epsilon_{ijk}$, where $TREATED_k$ is a dummy equal to 1 if a firm is treated (located in affected region) and zero otherwise. $TREATED_k$ dummy is interacted with year dummies ($\mu_t$), and we control for year and firm dummies. To allow identification, we have to withdraw one interaction between year dummy and $TREATED_k$ dummy. The withdrawn year is therefore the ‘baseline year’. We consider two specifications based on two baseline years. On the one hand, we consider the first year (2006) as a baseline year. On the other hand, we follow usual approach considering the last year before treatment as a baseline year (2010). Results are displayed in Supplementary Materials in Figures A3 and A4.
respectively. Figure A3 documents that firms in affected areas tend to under-perform from 2008 to 2014, in opposition with the pre-trend assumption. However, we see a sharp decline in crisis year (2011), and levels of productivity are rather similar in affected and non-affected areas from 2008 to 2010. The latter observation is in line with the second specification where the baseline year is 2010. As indicated in Figure A4, treated firms and control firms present similar performances from 2008 to 2010. However, firms in affected areas over-perform in 2006 and 2007. The most probable explanation of this divergence in trend is due to the occurrence of the first Ivorian crisis from 1999 to 2005 (officially terminated in 2007). The geography of conflicts in the first crisis is strongly similar to that of the Second Ivorian crisis. As a result, the positive impact on firms in affected areas is potentially driven by recovery in the immediate years after the end of fighting in 2005. This result is not only in line with our findings for the second Ivorian crisis (in the following) but also in line with macroeconomic evidence provided by Mueller et al. (2017), who document imperfect bounce backs just after conflicts (as in our analysis). The specificity of these years explained our choice to exclude periods from 2006 to 2008 in the baseline analysis. It should be noted that we rerun the event-study approach presented above on the period from 2008 to 2014 and we find results in line with the assumption of similar pre-trend between treated and control firms.

We adopt a second approach to test the parallel trend assumption (unreported but available upon request). This approach is to replicate the model on periods prior to the treatment and considering the last year as a placebo treatment. We adopt this method and find that coefficient associated with treated dummy is statistically insignificant, as expected. To conclude, both approaches tend to confirm the assumption of parallel trend.

17. Small and young firms are more flexible and can re-organize their production in a few weeks. At the opposite spectrum, large and old firms cannot easily change their organization and routines. In addition, small and young enterprises also intervene in local markets, contrary to large ones that rely on national or international markets (and therefore suffer from disruption in transportation). On the other hand, large firms are able to have a dense network of clients and suppliers. They can easily replace a defection (because a partner has disappeared). Older firms also have the advantage of experience (that is, of the first conflict) and may have developed strategies to cope with subsequent ones.

18. We present robustness checks for labor productivity only. However, we run robustness checks for TFP and results are in line with our baseline (results available upon request). We also estimate additional unreported robustness checks. First, we consider small and medium enterprises instead of all firms, by dropping companies with more than 100 employees in 2009. We then include all input dummies in the same specification because different proxies might reflect the same feature due to complementary in production technology. Finally, one might argue that input dummies capture a catching-up effect, explaining why labor-intensive firms perform better than firms that rely on skilled workers. To account for this problem, we include a lagged value of productivity (dynamic panel) without altering our conclusion.

19. Coefficients are not directly comparable but results are in line with the baseline models.

20. Technically, we apply a value of log(1) for exiting firms. We test other value [log(0.01), log(0.1)] without any difference in results.

21. In line with Camacho and Rodriguez (2013), we consider that a firm exits if we stop observing the firm in a given period and do not observe it again in the sample. Results of determinants of exit per year, displayed in the Supplementary Materials, indicate that input usage does not influence exit differently before, during or after the crisis. One exception is that firms having an higher debt ratio (less credit constrained) are less likely to exit during and after the political crisis. Exit is more likely for young firms and those operating under the status of limited liabilities (except in the year of the crisis for the latter). One exception is that firms having a higher debt ratio (less credit constrained) are less likely to exit during and after the political crisis.

22. For size and age, we rely on the median value to distinguish between both small and large and young and old. It should be noted that categories considered (foreign vs. domestic, small vs. large, young vs. old) is considered by the firm-fixed effect. In addition, we control for interaction between (POST × CONF) × SubGroup, because we incorporate in all estimations interactions between (POST × CONF) and firm’s characteristics.

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