COPING WITH POLITICAL INSTABILITY: FIRM INNOVATION IN SUB-SAHARAN AFRICA

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Abstract

Sub-Saharan Africa has been consistently plagued by political instability with long-lasting negative effects on economic growth and development. Given the importance of innovation in fostering growth, we posit that political instability will negatively affect firm innovative performance, and distinguishing between radical (i.e., process) and incremental (i.e., product) innovations. Further, we argue that this effect will be contingent on export and ownership status of firms. These hypotheses are tested using a dataset of 3,000 manufacturing firms from 15 sub-Saharan countries. Our results confirm that political instability is detrimental to all firm innovative efforts, but that export orientation moderates positively this relationship for product innovations. We do not find any significant difference in terms how foreign and domestic firms' innovation is affected by political instability.

Keywords: *Political instability, Innovation, Africa, Exports, Foreign ownership*

INTRODUCTION

Political stability is a critical ingredient for a country's economic development (Darby, Li and Muscatelli, 2004; Jong A Pin, 2009; Roe and Siegel, 2011). Stable countries are less likely to have their governments overthrown, experience civil unrest, or engage in war and violence, therefore providing a better environment for domestic and foreign firms to operate in (Delios and Henisz, 2000). While prior literature has documented a robust relationship between political instability and economic growth (Alessina and Tabellini, 1998; Polacheck and Sevastianova, 2012; Aisen and Veiga, 2013), little is known about the mechanisms through which these effects occur. So far, previous studies have focused extensively on the interplay between various forms of political instability and foreign direct investments, however, with mixed conclusions (Brunetti and Weder, 1998; Asiedu, 2006; Busse and Hefeker, 2007; Li and Vashchilko, 2010; Dai, Eden and Beamish, 2013).

While FDI is one of the channels through which political instability affects growth, in this paper we focus on another equally-important vehicle (i.e., innovation) that has been linked consistently to economic performance of firms, industries and countries (Li and Atuahene-Gima, 2001; Daneels, 2002; Krammer, 2009). National and regional innovation systems are more likely to flourish in stable countries, supported by better institutional environments (Freeman, 1995; Cooke, 2001) pro-business market reforms (Allard, Martinez and Williams, 2012) and productivity spillovers for foreign firms (Globerman and Shapiro, 2003). As a result, politically-volatile countries are less proficient in sustaining a functional ecosystem for innovation by failing to attract foreign investments, foster human capital,

develop domestic technological capabilities (Allard et al., 2012), and provide incentives to private firms to innovate (Furman, Porter and Stern, 2002). Despite the importance of firm innovation to the economic development of countries, to the best of our knowledge, there is no study that examines the effect of political instability on firm innovative performance.

We address this gap and examine the relationship between political instability and firm innovation in the context of 15 sub-Saharan countries. We focus on these countries for two reasons. First, most of these countries have struggled with significant political instability in their post-colonial history, depicting Africa as the most endemically violent region in the world (Straus, 2012). Moreover, sub-Saharan economies have been historically dependant on natural resources and raw materials, which in turn, have further increased the probability and severity of conflicts, especially in the presence of week institutional environments (Ross, 2004; Hodler, 2006). As a result, scholars have argued that the best way to break free from such resource-conflict vicious cycles is to diversify their economy through innovation and pursue inclusive growth measures to reduce inequality and poverty (Collier, 2007).

Second, despite the conspicuous significance of innovation for growth, sub-Saharan Africa still underperforms severely in terms of R&D investments, technical competence building, human capital, and quality of the business environment (Juma, 2005). For instance, Africa's contribution to the global pool of innovation as proxied by its share of scientific and technical articles remains modest at best (less than 1 percent of the total), even when compared with other developing countries in East Asia (24.15 percent), South Asia (2.72 percent), or Latin America (3.04 percent). Overall, this is indicative of the severe challenges that innovators face in Africa, such as access to capital, weak property rights, lack of human resources, and inadequate infrastructure (Oluwatobi, Efobi, Olurinola, and Alege 2014).

With this paper we propose two theoretical contributions that augment the international business and innovation literature as follows. First, we develop theoretical arguments regarding the effect of political instability on innovation at the level of the firm. While the few studies who have examined the link between instability and innovation lack clear theoretical mechanisms and rely on aggregated country-level (Waguespack et al., 2005; Allard et al., 2012) or single-industry (Fosfuri, 2004) data, we examine the role of political instability on firm-level innovation, arguing that political instability affects firm innovation via greater uncertainty of demand for its future products (Schmookler, 1962; Rodrik 1991), distrust and volatility regarding the quality of institutions (Varsakelis, 2006; Gwenhamo et al., 2012), as well as financial capital (Ayyagari et al., 2012; Cumming et al., 2015) and human capital (Schneider et al., 2010; Aisen and Veiga, 2013) constraints .

Second, we argue that export orientation and foreign ownership of firms in these countries will moderate positively the effects of instability on innovative performance. Exporters benefit from additional markets and niches that provide them the ability to stabilize their revenues (Hirsch and Lev, 1971), secure financial resources (Goldbach and Nitsch, 2014), and learn from international markets (Salomon and Shaver, 2005), which spur their innovative performance (Golovko and Cassiman, 2011). Nevertheless, exports will more likely moderate the effects of political stability on incremental (i.e., product) rather than radical (i.e., process) types of innovation (Becker and Egger, 2013). Moreover, firms may get relief from the negative influence of political instability by being a foreign affiliate of a multinational enterprise (MNE). MNEs have developed strategies to deal with political adversity (Kesternich and Schnitzel, 2010) and weak institutional regimes (Zhao, 2006), which in turn shelters their innovative performance from the effects of political instability. However, especially in the case of violence and severe instability, foreign firms and affiliates appear to suffer more hardship (Klapper et al., 2015), which would negatively affect their

innovation performance. Thus, in theory, foreign ownership can moderate this relationship both positively and negatively.

These conjectures are tested using a sample of 3,000 firms from15 African countries that exhibit significant heterogeneity in terms of both innovation performance and political instability. To this end, we examine two critical components of firm innovative activities (i.e., product and process innovations) and three dimensions of political instability (absence of violence and stability, battle related deaths, and change of governments). Our results support a significant and negative relationship between all dimensions of political instability and innovation (both product and process). All else equal, an average firm in Botswana (instability score of 1.6) is 21 percent more likely to innovate than an Angolan counterpart (score 4.2). The innovative performance of exporting firms are less affected by political instability resulting in a lower depreciation of probability to innovate (-0.1) as compared to non-exporters (-0.5) when facing severe changes in the stability. Finally, foreign ownership does not appear to moderate this relationship, suggesting that MNEs' innovative performance is just as affected by political risk as that of domestic firms in these countries.

Together these findings advance the literature by emphasizing the joint significance of the macro (country-level) and micro (firm-level) context for firms' strategies. They provide policy-relevant insights into the effects of political volatility on innovation performance of both domestic and foreign firms, with inherent consequences for rekindling growth in the sub-Saharan region. The remainder of this paper is organized as follows: next section presents the theoretical background and develops testable hypotheses for the direct effects of political instability on innovation, and two potential moderators of this relationship. Section 3 elaborates on the empirical set-up, data, and estimation results, while Section 4 concludes and discusses managerial and policy implications.

THEORY AND HYPOTHESES

Determinants of innovation

Innovation has been acknowledged as the critical ingredient for sustained economic growth and development (Romer, 1986; Hall and Jones, 1999; Ahlstrom, 2010). As a result, numerous studies have focused on explaining what makes certain firms, industries and nations more innovative than others. Overall, this volume of work concludes that innovation stems from a variety of factors that span across multiple levels of analysis. At the macro-level, innovation appears to be driven by complex regional and national ecosystems of innovations in which various actors (e.g., firms, universities, governmental entities) interact in complex ways (Cooke, 2001; Furman et al., 2002; Freeman, 1986). In addition to regional and national characteristics, another body of work has focused on industry, firm, and individual characteristics as potential explanations for differences in terms of innovative performance. Together, these studies document the heterogeneous and multi-level determinants of innovation which range from macro-factors such as firm size, competition, access to resources, networks, or technological regimes, to individual characteristics such as cognition or personality (Damanpour, 1996; Markard and Truffer, 2008).

In this study we are going to focus on firm innovation in sub-Saharan economies, as proxied by product and process innovations, following the classification proposed by the OECD (2005). According to it, product innovation represents any good or service that is new or significantly improved (e.g. in terms of technical specifications, components and materials, software, user friendliness or other functional characteristics). In turn, process innovation is associated with new or significantly improved production or delivery methods (e.g., significant changes in techniques, equipment, or software). In the literature, product innovation is commonly regarded as a key prerequisite for market entry, following the

Schumpeterian argument of creative destruction, while process innovation assists firms in securing its market position given their available pool of products and resources. From a degree of novelty of innovations, we consider product innovations (in the form of product line extensions or modifications of products) to be incremental, while process innovations (in the form of new production technologies designed to expand the range of products and markets served) to be more radical in nature, i.e., more likely to create or replace existing market niches (Ettlie, Bridges and O'Keefe, 1984).

Besides the distinction between these two types of innovation, it is also important to mention the role and nature of innovation in sub-Saharan Africa. Innovation in the form of technological progress and catch-up is at the heart of development issues that characterize this region (Juma, 2005; Oluwatobi et al, 2014). Given its role as an engine for economic growth worldwide, and the relative lower income per capita of African nations, the notion that innovation can accelerate growth in this region has received significant attention, despite the obvious lack of inputs (e.g., good quality institutions, trained human capital, national and regional systems of innovation, etc.) without which innovation cannot exist. As a result, African innovation tackles mostly local demand and needs rather than addressing technological issues as “the frontier” of science and technology. Moreover, it occurs mostly through absorption and adaptation of technologies produced elsewhere, rather than invention and internal development of new technologies (Goedhuys, 2007).

Political instability and its consequences

Political stability refers to the institutional status quo and the interpretation of these rules and regulations within a single and stable institutional setting (Waguespack, Birnir and Schroeder 2005). In contrast, political instability is characterized by more frequent switches of policies, collapse of governments, and can often result in violence and even civil war (Alesina et al.,

1996). Nevertheless, the manner and magnitude in which firms and countries are affected by political instability differs significantly.

At the country level, most studies examining the effects of political instability have focused on its effect on economic growth. Alessina and Tabellini (1989) develop a theoretical model in which instability leads to government change, followed by new and redistributive policies which lead to higher uncertainty for investors resulting in a so-called capital flight, where investors relocate to another (more stable) country. Besides an increase in investment risk, they also argue that instability will yield more public debt (to be serviced by future governments) which in turn will affect negatively growth in the future. Similarly, political volatility reduces the possibility of re-election, providing incentives for governments to over-spend and shifts funds from investments to consumption with negative consequences for economic growth (Darby et al., 2004). In extreme cases, where instability translates into conflicts or civil war, assets and infrastructure are destroyed, investments decrease, and depreciation rates increase (Collier, 1999; Weinstein and Imai, 2000). Overall, political instability affects adversely economic growth by lowering productivity rates, and to a lesser degree physical and human capital accumulation (Aisen and Veiga, 2013), reducing annual growth of a country from 0.01-0.13 percent in the case of civil wars to 0.19-2.77 percent in the case of inter-state conflicts (Polacheck and Sevastianova, 2012).

Evidence the effects of political instability on firm performance remains scarce. Early papers on firm outcomes have employed stock market returns to tackle this question. For example, Abadie and Gardeazabal (2003) find that the cease-fire declared by the terrorist group ETA in the Basque country resulted in excess returns for firms operating in this region, suggesting that terrorism affects negatively the expected returns of investments. In turn, Guidolin and La Ferrara (2007) find the opposite effect in the case of diamond mining firms operating in Angola before the end of the civil war in 2002. This implies that conflicts might

actually have been beneficial to incumbents as a way to deter entry and secure lucrative exclusive deals that otherwise would not have been possible. Overall, political instability has strong effects on firm performance which leads to technical regress and loss of skilled workers (Collier and Duponchel, 2013), translating into significant drops in export volumes (Ksoll et al., 2010) and productivity levels (Klapper et al., 2015)[1].

Political instability and firm innovation

Despite the clear connect between political regimes and a wide array of policy choices including innovation, there is little evidence on the link between political elements and innovation performance. In theory, political aspects have the potential to both enhance and undermine public policies to spur innovative processes and products (Courvisanos, 2009). Thus, loss of economic power, policy and industrial control by incumbents can all be offset via multiple policy responses such as subsidies/tax concessions for R&D, stronger intellectual property rights (IPR) regimes, deregulation initiatives, public contracting or new industrial relations policies. Some of these channels have also been validated empirically by prior studies. Waguespack et al. (2005) posit that, all else equal, stable political environments will be more conducive of patenting activities, both nationally and internationally. Within a sample of 27 Latin American and Caribbean countries they find out that political stability matters for innovation as proxied by international patenting rates. Moreover, the type of government affects both national and international patenting, with democratic regimes outperforming authoritarian ones. On the other hand, technological transfers are not sensitive to political , financial and economic risks, probably as a result of international treaties and dedicated internal mechanisms (Fosfuri 2004). Overall, these studies suggest that the effects

[1] Ksoll et al. (2010) find out that violence during the 2007 Kenyan general election resulted in a 38 percent drop in the exports by flower producers. Klapper et al. (2015) document a decline of 16-23 percent in firm total factor productivity as a result of unrest in Cote dÍvore in 2000, and a 5-10 percentage points larger decline for firms that are owned by or employing foreigners.

of political instability on different types of innovations remains ambiguous, especially when considering the heterogeneity of firm responses to such events.

We argue that there are several mechanisms through which political instability may affect firm innovation. First, political instability will reduce the overall investments made in a country, and especially those related to riskier, long-term activities such as innovation. Rodrik (1991) exemplifies this as a “dilemma” for developing countries seeking to reform their policies and institutions: on one hand, entrepreneurs and workers must respond to the reform in order for the new policies to be successful; on the other, rational behavior prevents private firms from investing until much of the residual uncertainty regarding the success of the reform is eliminated. Such reactions from private firms are further exacerbated for riskier and more long-term oriented activities (i.e., innovation), and in the presence of higher-order forms of instability (e.g., conflict or civil war). In relation to innovation, greater political instability will affect negatively the demand for future products and implicitly firm profits generating less resources (i.e., R&D investment) for future innovations (Schmookler, 1962). Furthermore, the overall reduction in expected revenues will translate into an effective redistribution of funds from peripheral and riskier endeavors to core-activities needed to stay afloat. Thus, as profits decrease in expectation, firms will be less inclined to fund innovation, which already entails a certain degree of uncertainty even in the absence of political volatility (Wu et al., 2014).

Second, political instability is intertwined with the perceived quality of formal institutions and their facto enforcement. Overall, better institutional regimes have been associated with more adoption of technologies and faster productivity growth (Manca, 2010), creation of new technological innovations (Tebaldi and Elmslie, 2008), and well as positive spillovers from foreign R&D via trade and investment flows (Coe et al., 2009; Krammer, 2015). One aspect of formal institutions which has been consistently linked with innovation and creation of new technologies is the intellectual property rights -IPR- (Arora, Fosfuri and

Gambardella, 2001). Despite the increasing regulatory convergence worldwide as a result of globalization, there is still great heterogeneity in terms of IPR standards worldwide (Park, 2008). In periods of great political turmoil, pursuing and enforcing good regulatory institutions is often abandoned, as governments opt to follow other priorities to tackle the root causes of this instability. Thus, political instability has a strong negative influence on property rights (Gwenhamo et al., 2012), increasing the appropriation concerns associated with technological innovations (Pisano, 1990). Furthermore, political instability will often result in lengthy regulatory reform and institutional change that will affect innovation policies and the structure of a country's innovation system, i.e., the idiosyncratic norms, rules and laws and also governmental entities (Varsakelis, 2006). As a result, innovators will have lower incentives to innovate in periods of political turmoil.

Thirdly, innovating firms will have less financial resources available for innovation during episodes of political instability. Given that many firms lack the capital to fund large-scale R&D projects, access to finance (in the form of loans and capital markets) is one of the critical ingredients for innovation in firms (Ayyagari et al., 2012). In politically volatile times, banks are more hesitant in giving loans given the existing uncertainty in the market about the direction of the country, which in turn increases the risks of defaulting on loans, as well as inflationary concerns (Wu et al., 2014). Hence, private loans are strongly associated with innovation if political instability is low. An alternative channel through which firms can finance their innovative endeavors is through public funding, often as a result of political connections with governmental officials. As political instability brings along with it deep and unexpected change to the legislature, it also reduces the scope for securing public funding through political connections (Cumming et al., 2015). Therefore, political instability reduces effectively firms' ability to access external loans (private or public), thereby affecting negatively their propensity to innovate.

Finally, political instability harms innovative performance by reducing the availability of qualified human capital. Human capital, often defined as a set of knowledge, ability and skills of individuals was always found to be a stimulus of innovative processes across firms, industries and countries (Vandenbussche et al., 2006; Schneider et al., 2010; Bartelsman et al., 2014). At the firm level, human capital is linked with knowledge creation (Smith et al., 2005), learning by doing (Liebermann, 1987), and absorptive capacity (Cohen and Levinthal, 1990), all with positive implications for firm innovation. Better-educated employees provide more innovative output than less well-educated ones (Schneider et al., 2010), and formal training on processes and learning of specific skills is often associated with introduction of innovative products and processes (van Uden et al., 2015). However, political instability results in a reduction of human capital both through a decrease in the educational levels of population and the reduced scope of formal training provided by firms following an economic contraction in this turbulent period (Aisen and Veiga, 2011). Furthermore, in the case of significant violence, worker absenteeism is a difficult obstacle to overcome, even for securing daily firm operations (Ksoll et al., 2010), not to mention innovative activities.

All the above mechanisms suggest that political instability will bear clear negative consequences for firm innovation via greater uncertainty about demand for products (and implicitly future revenue streams), quality of existing institutions (in particular IPR), availability of finance and human capital. These mechanisms will affect both radical and incremental innovation alike, although to different extents given their differences in terms of reliance on human capital and financial resources (Ettlie et al., 1984). Hence, we posit that:

Hypothesis 1: There will be a negative relationship between political instability and firm propensity to introduce radical and incremental innovations.

The role of exports and foreign ownership

Although the effects of political instability will be felt by all actors in an economy, we argue that international diversification through exports and foreign ownership will provide a way to reduce these impact of these hazards through several mechanisms.

First, exports will provide additional markets and niches for firm products. This will ensure a more certain stream of revenues for the firm, and a greater likelihood that all activities (including innovative endeavours) will be kept in the future, regardless of the turmoil existing in the home market (Hirsch and Lev, 1971). As a result, exporters outperform non-exporters even in periods of significant political and economic crisis (Mangena, Tauringana and Chamisa 2010). Furthermore, in the case of prolonged or grave instability, exporters may shift their focus away from their home market to new export and FDI activities to replace the revenues lost in the former. Implicitly such an international focus will trigger a stronger demand for its products and services acting as a demand-pull driven for their product and process innovations (Cassiman and Golovko, 2011).

Second, “learning by exporting” is a channel through which firms acquire additional technological expertise and are able to improve their innovative performance (Salomon and Shaver, 2005). While the causal direction of this relationship is still subject of debate in the literature, the positive correlation between exports and innovation is a common empirical finding. Thus, scale or competition effects in foreign markets incentivize exporters to engage in more innovation (Cassiman and Golovko, 2011), access to foreign sources of knowledge via spillovers (Coe et al., 2009), cross-country differences in terms of available technologies can convey important technical information to exporters (Clerides, Lach, and Tybout, 1998). As a result, exporters develop and adopt more easily foreign technologies, thereby being able to introduce more innovations in local markets despite political volatility.

Third, by taping foreign markets, exporters will improve their chances securing financial resources. Exporters are usually perceived to be the most efficient and better managed firms in an economy (Clerides et al., 1998), often associated with higher productivity, wages and innovative performance. Firm success across different markets provides significant reassurances for banks in the home country that the business will survive the current wave of political volatility. As a result, exporters often receive more and larger loans from banks than non-exporting firms (Goldbach and Nitsch, 2014). Moreover, if domestic banks and financial institutions are still concerned about the chances of repayment, exporters can also access additional financial resources via banks and partnering firms in their export markets. Better access to financial resources will translate also in more opportunities for exporters to finance their innovation activities (Ayyagari et al., 2012).

Finally, catering to other markets will provide firms with more options on what products/services to deliver to local as opposed to export markets. Given the deterioration of political landscape at home, firms will likely focus their operational and innovation efforts more on their export markets. As a result of differences across borders in tastes and standards, exporters will focus more on developing new products to satisfy demand in these markets, rather than developing new processes which would affect radically the nature of their production, and also require significant capital investments (Becker and Egger, 2013). As a result, exporters will be better equipped to deal with political instability, and this ability will be more likely seen in the form of new products, rather than new process innovations. Thus:

> *Hypothesis 2: Exporting firms' propensity to innovate will be less affected than that of non-exporting firms, and these effects will be more pronounced in the case of new product innovations.*

Besides international orientation via exports, firms may also find relief from political volatility in a country when being part of a bigger, multinational firm. Thus, we argue that the degree of foreign ownership will positively moderate the effects of political instability for several reasons.

Multinational firms (MNEs) are some of the most productive firms in the world (Melitz, 2003). This allows them overcome the liability of foreignness and to operate successfully across multiple geographical markets. Two common ways in which MNEs deal with risks stemming from political instability are ownership strategies and leverage (Kesternich and Schnitzel, 2010). As the effects of political instability become more acute MNEs are more likely to reduce their stakes in affiliates from countries plagued by this problem, and seek to finance these activities via loans (either in host or home countries) rather than equity, which in turn allows them to keep normal operations and minimize these risks.

Second, foreign-owned firms will be less affected by the decaying quality of institutions (such as IPR) as a result of political instability. Zhao (2006) argues that MNEs perform quite often innovation-related activities (such as having R&D operations) in low-quality IPR jurisdictions, given that they have perfected dedicated internal mechanisms to substitute for the lack of strong IPR prescriptions. As a result, the risks of technological leakage are reduced and the innovative performance of these subsidiaries is less affected than domestic firms in these markets.

Finally, being part of a multinational group provides access to a larger pool of capital, human resources, and best practices (Contractor, 2012). In such cases, cross financing of activities between different affiliates in a multinational is common, providing financial resources to those affected by credit crunches in their home market as a result of political instability. Furthermore, management of human capital within a multinational group

represents one of its strengths, as it provides flexibility and access to high skilled resources among its affiliates, regardless of their local environments (Mangena et al., 2010).

While foreign ownership provides many benefits to firms operating in politically instable environments, there are also reasons for which foreign firms might actually be more affected by instability than domestic ones, especially in the context of severe civil conflicts or interstate wars. Anecdotal evidence suggests that in such instances, violence is often directed at foreigners and their business, as a result of nationalistic concerns. In response, this affects negatively MNE presence in the country and on aggregate, FDI inflows to that economy (Asiedu, 2006). Besides these discriminatory punitive measures, there is robust empirical evidence linking political instability to performance of foreign firms. Klapper et al. (2015) find that foreign firms in Cote D'Ívore were more affected than domestic firms by the political violence in the early 2000s, resulting in 5 to 10 percent larger productivity drops for these firms as opposed to their domestic counterparts. Likewise, Mangena et al (2010) suggest that foreign-owned firms were affected to a similar, if not higher, extent than domestic firms by political instability in Zimbabwean crisis of 2000-2005. On the other hand, the existence of natural resources or the state-ownership of these enterprises can mitigate these losses, as shown by Ramasamy, Yeung, Laforet (2012) in the case of Chinese multinationals. Hence, given the conflicting arguments proposed, we have:

Hypothesis 3a: Foreign-owned firms' propensity to innovate (via new products and processes) will be less affected than that of domestic firms.

Hypothesis 3b: Foreign-owned firms' propensity to innovate (via new products and processes) will be more affected than that of domestic firms.

METHOD

Data sources and sample

To test our theoretical predictions we employ firm level data on innovation from the Enterprise Survey (ES) initiative of the World Bank Group. These surveys comprise face-to-face interviews with top managers and business owners over 130.000 companies in 135 countries worldwide. The surveys cover different business topics like finance, corruption, crime, infrastructure, competition, and performance measures. For this study, we employ data on Sub-Sahara collected in the period 2006 and 2007 (the exact date varies for each country). Only these rounds of surveys provide questions on the topic of innovations, and moreover, the available data is restricted to manufacturing sectors only (see **Table 2**). The entire sample consist of 4,737 firms across 15 countries, namely Angola, Botswana, Burundi, Democratic Republic Congo (DRC), Gambia, Guinea, Guinea Bissau, Kenya, Mauritania, Namibia, Nigeria, Rwanda, Swaziland, Tanzania and Uganda. After removing all missing observations for our main variables of interest we are left with a sample of 3,007 firms. The distribution of these observations across countries is given in **Table 1**, with countries like Nigeria, Kenya and Uganda having the bulk of firms in the sample. Finally, an overview of all variables used, primary sources of data, and details on their measurement is provided in **Table 3**.

Dependent variable. Following prior studies (Goedhuys, 2007; Fritsch and Görg, 2015), firm innovation will be measured as the output of innovation activities in the form of product and process innovations (Goedhuys and Veugelers, 2012). Using the answers to the questions "*During the last three years, did your establishment: introduce into the market any new or significantly improved products (goods or services)?* and respectively "… *any new or significantly improved production processes including methods of supplying services and ways of delivering products?*?" I compute two binary dependent variables (Product/service

innovations and Process innovations), which take the value of 1 for positive ("yes") answers, and 0 otherwise.

Independent variables. The Enterprise Surveys provide rich perception-based information on the business environment in which firms operate it, including firm activities, interactions with competitors and governmental officials. Incidentally, there is also a subjective measure of political instability ("*Do you think that the following presents any obstacle to your current operations of your establishment: political instability*"). Nevertheless, given the simultaneous nature of this information with that regarding innovation, and the potential issue of common method bias, we opt for using other measures of political instability from secondary data, and from preceding years of the surveys, under the assumption that the effects of political instability will occur with a lag rather than instantaneously.

As a result, our main measure for *political instability* comes from the World Bank's Governance Indicators (WGI), specifically the dimension capturing political stability and the absence of violence and terrorism. This measure has been widely used in the literature (May et al., 2002; Globerman and Shapiro 2003; Kauffmann et al., 2008; Allard et al., 2012) and measures the perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. To construct this measure the authors combine 10 factors (from terrorism, civil unrest, ethnic and religious conflicts to international tensions, autonomy or segregation protests) from different sources into a meta-analysis from which they derive aggregated (country-level) values for political stability. A list of these indicators is provided at http://info.worldbank.org/governance/wgi/index.aspx#doc. Overall, the values of this index are normally distributed, ranging from -2.5 (very unstable) to 2.5 (very stable). Given our interest on the reverse of this issue (i.e., political instability) we recode this variable inversely so that a value of 2.5 means a highly unstable country. Furthermore, we rescale the resulting variable by adding 2.5 to all the values. This means that the new variable ranges from 0 (very

stable) to 5 (most unstable). As mentioned before, in order to avoid a simultaneity bias with our measures of innovations (recorded in 2006 and 2007), and moreover to weigh-in the effect of an isolated incident that affects political stability in a country, we take the average of this indicator for the period of 2000 to 2004. To give an example, the most politically stable country in my sample is Botswana with a value of 1.57 and the most instable country is Burundi with a value of 4.84.

Export orientation will be measured as a share of exports in the total sales, summing up the percentage of direct exports with the percentage of indirect exports, as measured by the corresponding questions in the ES. Subsequently, since we only hypothesize about the export orientation of firms (as opposed to their export intensity) we compute a new dummy variable (Export) which captures whether a certain firms exports directly or indirectly to other markets.

Foreign ownership is measured as the percentage of the firm that is owned by foreign entities (firms, individuals or governments), and then transformed into a dummy variable (Foreign), which equals 1 if the firm is more than 50% foreign owned, and 0 otherwise.

Controls. To account for any idiosyncratic effects between different industries in terms of their natural propensity to introduce product and process innovations (i.e., mature, low-tech and concentrated industries have a slower pace of technological innovation than young dynamic and high-tech ones), I employ industry fixed-effects throughout all my estimations. Moreover, I include a wide range of firm-level and country-level controls which have been documented extensively in the literature to affect innovative performance of firms (Lederman, 2010).

The first such control variable is *firm size*. Shefer and Frenkel (2005) find evidence that larger firms tend to be more innovative compared to smaller firms, as the former often have more financial capabilities to innovate. Firm size is measured as the total number of

employees at the end of the year before the survey. Furthermore, better performing firms have often more possibilities (of financial and non-financial nature) to innovate (Fritsch and Görg 2015). Thus, we also control for *firm performance* using a simple metric for profits, computed as the total firm sales minus the operating costs (land, building, etc.) and the cost of labor. There is also evidence that suggests that younger firms are keen on taking innovative efforts than older firms, who are hesitant to change their ways (Goedhuys, 2007). In turn, pending on the industry and country context of firms, older firms might be in a better position to innovate given their experience and accumulated stock of knowledge (Huergo and Jaumandreu, 2004). Regardless of which effect will prevail in the case of our sample, we control for *firm age* in all our regressions, by using a measure derived from the year of the survey minus the reported first year of operations. *High-skilled labor* is an important prerequisite for innovating firms (Gorodnichenko and Schnitzer, 2013), therefore we capture and control for this effect using a question from ES that asks firms whether inadequately educated labor force represents an obstacle for the current operations of the firm (on a scale of 1 to 4). *Competition* and pressures from competitors, especially foreign ones that commonly poses superior technological capabilities and technologies, has also been linked with innovative performance (Aghion, et al 2005). Manager's experience in the industry is also a strong predictor of firm innovation (Balsmeier and Czarnitzki 2014), since experienced managers are better equipped to identify future threats and opportunities for firm innovation. Finally, *state ownership* has commonly been identified as drag on innovative performance of firms given the disconnect between expected payoffs and performance of firms in all domains, innovation included (EBRD, 2014). As a result, a common finding in the literature is that state-owned firms are less innovative than privately owned ones.

Besides firm-level characteristic, there are also country-level characteristics that might drive one's propensity to innovate. According to the extant literature, in order to be proficient

in innovation, firms need a well-functioning national innovation systems (Lundvall, 2007). A critical component of such systems, which enables innovators to innovate more in the future, is the existing stock of knowledge in an economy (Furman et al., 2002; Krammer, 2009). Following this literature, we use the stock of *patents* granted in the USA as a proxy for a country's national innovative capacity that is relevant at the world frontier. This stock is computed as a simple count of all patents granted in the USA between 1946 and 2002 per 1,000 inhabitants according to the nationality of the inventor. Again, we stop in 2004 to avoid the issue of simultaneity with our measures of innovation. In addition to this, we also include for GDP per capita, as a universal control for market size, wealth and quality of institutions (under the proven assumption in the literature that higher GDP per capita is correlated with better institutions). Lastly, we include a measure of FDI (foreign direct investment) stocks in a country, given the documented spillover effects from MNE and trade activities (Gorodnichenko and Schnitzer, 2013).

---- INSERT TABLE 4 HERE ----

Table 4 provides the descriptive statistics for all of the variables in the model. On average, 50 percent of all the firms introduced new products or services in the previous three years. For production process innovation the percentage is 58 percent. 15 percent of the firms where involved in exports and 11 percent of the firms where majority-owned by foreign entities. As expected, the propensity to introduce product and service innovations is higher for exporting firms (64 percent) than non-exporting firms (48 percent), also for foreign-owned (54 percent) vis-à-vis domestic ones (50 percent). These results hold for process innovation as

well[2]. Furthermore, all correlations between our main variables of interest are within acceptable limits (see **Table 5**).

---- INSERT TABLE 5 HERE ----

Estimation technique

While we can distinguish both between product and process innovation, often these innovative strategies are mutually reinforcing because increasing the level of any of them will automatically raise the marginal productivity of the other (Miravete and Pernias 2006). As a result, in many instances product and process innovations complement each other (Goedhuys and Veugelers 2012) requiring consistent estimation techniques with this complementarity. As a consequence, successful firm innovation – both in the form of new products/services and new processes- is modelled following a bivariate probit model which relates the probability of being a successful innovator to political instability (PI), export orientation (EXP), foreign ownership (FOR), and certain firm (F_i), country (C_n) and industry (S_m) characteristics. Thus, we estimate the following bivariate probit model, using the same set of explanatory and control variables as regressors:

$$Prod\ innov_i = \alpha F_i + \beta C_n + \gamma S_m + \delta PI_n + \vartheta PI_n * EXP_i + \rho PI_n * FOR_i + \tau_{1i}$$

$$Proc\ innov_i = \alpha F_i + \beta C_n + \gamma S_m + \delta PI_n + \vartheta PI_n * EXP_i + \rho PI_n * FOR_i + \tau_{2i}$$

In turn, the bivariate probit estimator takes explicitly into account the potential complementarity between process and product innovations in the form of the parameter rho, which captures the correlation between the error terms of the two equations :

$$E[\tau_1] = E[\tau_2] = 0\,, \qquad Var[\tau_1] = Var[\tau_2], \qquad Cov[\tau_1, \tau_2] = \rho$$

[2] 70 percent of exporting firms report process innovations as opposed to 55 percent for non-exporting; Similarly, 63 percent of foreign-owned firms as opposed to 56 percent for domestic ones.

Main results

Table 6 reports the results of the bivariate probit taking into account firm's interdependent decision to pursue product and process innovations. Model 1 lists the battery of controls both at the level of the firm and at the level of the country, and will serve as a benchmark throughout the rest of the estimations. Several interesting insights emerge already from these results using only control variables. Among the firm attributes, its economic performance is tightly and positively related to its propensity to innovate. Moreover, larger firms appear to be more innovative than smaller ones, which is consistent with other findings in the manufacturing sector. Innovating firms in sub-Saharan Africa are also more dependent on the quality of available human capital, which remains a key component for innovation in any region. Furthermore, competition has a positive effect on product innovation, in accordance with previous findings in the literature (Aghion et al., 2005). However, the results present an interesting finding: namely the intensity of this competition affects positively firm's propensity to introduce new products, most likely in response to new competitors (Slivko 2012), but not process innovations, which tend to be more radical and require more resources and capabilities. On the other hand, the presence of foreign competitors triggers process innovations, suggesting that the nature of competition in this case requires a stronger and more radical response from firms than the diversification of product portfolios.

At the country level, the level of development as reflected by the GDP per capita, has a strong and positive effect on both types of innovations. The effect of patent stock in the USA, as a proxy for new-to-the-world knowledge has a large positive effect, but seldom significant statistically, suggesting that the types of innovations produced by firms in sub-Saharan Africa has little in common with their national endowments in terms of science, technology and innovation, as captured in previous studies (Furman et al., 2002). Instead African innovation

targets mostly the needs of local demand, and is better characterized as new-to-the-market (Goedhuys, 2007). Finally, the effect of FDI stock in these countries has a negative and robust effect on both types of innovations suggesting that the presence of MNEs has done little to improve average innovation performance of these economies. While this might appear somewhat counter-intuitive, it is consistent with previous findings in the literature that fail or find contradicting results regarding the effects of FDI on productivity of firms, and economic growth in this region (Managi and Bwalya, 2010; Njoupouognigni, 2010). Moreover, Sun (2002) also found that in countries with weak market structures and institutions FDI is often more exploitive and rent seeking in nature.

----- INSERT TABLE 6 ------

In Model 2 we test our main conjecture of the paper, namely that political instability will affect negatively firm innovation, in terms of new products but also new processes. The coefficient of PI derived from the World Bank Governance Indicators it negative and highly significant, confirming that, all else equal, as instability increases firms are less likely to innovate. This effect remains negative and highly significant throughout the rest of the estimations. Then, Model 3 tests our second hypothesis regarding the moderating effects of export orientation. The coefficient of the export dummy variable is negative and significant in the case of product innovation, suggesting that export firms are less likely to introduce product innovations, probably due to a thinning of existing resources that entails certain strategic choices. The coefficient of the interaction is positive and highly statistically significant confirming our theoretical conjecture that exporting firms will be less affected by political instability than firms who serve only their domestic markets. However, export orientation of firms appears to be unrelated to firm's propensity to introduce new product innovations, consistent with our theoretical arguments and the classification of process innovation as being closer to a radical than incremental type of innovation. Model 4 tests our

third hypothesis, namely that foreign ownership will moderate the relationship between political instability and innovation. Despite the alternate theoretical arguments developed in this paper, the empirical results fail to provide any statistical significance for these effects. The coefficients of both foreign ownership dummy and the interaction with political instability are both insignificant. Finally, Model 5 incorporates all the variables and interactions and the results are similar.

To illustrate the moderating effects of export orientation on the relationship between political instability and firm's propensity to introduce new product innovations, I have also plotted these effects in **Figure 1**. Non-exporters appear to have a greater propensity to introduce more incremental innovations in the form of new products and services, given their extra-resources and slack as compared to exporters that have to deal with liability of foreignness and transactions costs associated with exports (Ksoll et al., 2015). Therefore, in the absence of political instability, they will be more proficient at incremental innovations (i.e., new products and services). However, as the degree of political instability increases these firms will be more exposed to demand shocks, capital and human shortages, which will take a toll on their innovative performance (from 0.8 when PI =1 to 0.4 for PI=4.5). In turn, exporters will be much less affected by an increase in political instability (from 0.6 when PI=1 to 0.5 for PI= 4.5), as they will be able to rely on demand from foreign markets, and finance their activities through external sources of capital.

---- INSERT FIGURE 1 HERE---

Robustness checks

To test the robustness of our findings we perform several checks first, by using other proxies for political instability and second, by employing continuous measures for our proposed moderators. The WGI political instability measure is a comprehensive measure of different

kinds of instability together. In this case more severe scenarios of political instability (e.g., wars, conflicts) tend to get averaged out with milder events (e.g., governmental change, minor civil unrest). With these additional checks we are also testing the argument that more severe kinds of instability will bear deeper negative consequences for firm innovation in these countries. To this end, we examine a milder form of political instability, namely government change, (Haber and Maurer 2004; Gurgul and Lach 2013; Aisen and Verga 2005), and a more severe one, as reflected by the number of battle related deaths (Weinstein and Imai 2000; Serneels et al., 2012).

The degree of *government change* is a measure of the number of adverse regime changes between 1955 and 2004 multiplied by the degree of polity change which has stemmed from the regime change. The data comes from Center for Systemic Peace. We measure more extreme violence using the number of battle-related deaths (BRD) provided by the World Bank Group, and available through the World Development Indicators http://data.worldbank.org/indicator/VC.BTL.DETH. Battle-related deaths are deaths in battle-related conflicts between warring parties in the conflict dyad. We measure BRD in a time frame of 10 years, between 1994 and 2004, thus preceding the timing of innovation in the ES to capture the medium and long terms effects of instability (Sach, 2005). The results of these estimations are not reported in the paper, but are available upon request. Overall, the findings regarding the effect of political instability on innovation remain unchanged. Both government change and the battle related deaths have strong and significant negative effects on firm innovation.

However, the results concerning interaction effects differ from the benchmark result reported in **Table 6**, suggesting that as instability intensifies and becomes more severe exporters will endure similar effects to non-exporters, while foreign firms might be more affected than domestic-owned ones. The results using a milder measure of instability are in

line with those obtained using the WGI measure, namely robust and negative, while moderated by the export orientation of the firm. In turn, when it comes to extreme instability (as proxied by higher BRD values), exports do not function anymore as a moderator and moreover the effects for foreign-owned firms appear to be worse than for domestic-owned ones. This is consistent with other anecdotal evidence of increasing violence against foreigners and their business during conflicts, confirmed by Klapper et al. (2005).

Finally, both export orientation and foreign ownership are binary measures in our baseline estimations under the assumption that by having access to foreign markets, either via exports or via foreign parent companies, firms will be better equipped to cope with distress from political instability. Nevertheless, we would like to test this also by looking at the intensity of this access, and therefore using a continuous measure of exports and foreign ownership to test these moderating effects. The results are in line with our previous conjectures suggesting that on average, exporting firms have a better chance to escape the negative influence of instability in terms of innovative performance, and that more foreign ownership has actually more negative effects on firm innovative performance in the case of severe disturbances, such as the ones captured by a large number of battle related deaths

Magnitude of these effects

Given the nonlinear nature of our chosen estimator, the coefficients reported in **Table 6** and those in the robustness are harder to interpret. Because of this, **Table 7** reports also the marginal effects for our main variables of interest, namely the control variables and the different proxies used to measure political instability. Regardless of the fact that these coefficients cannot be compared analytically across models, qualitatively they support the idea that the degree of political instability is also critical for innovation, and that these negative effects tend to be larger in cases of major volatility incidents (i.e., conflicts which

result in victims) as opposed to minor episodes (i.e., change of governments). Furthermore, interpreting these marginal effects may provide a more intuitive picture of the relevance of political instability for both product and process innovation of firms.

---INSERT TABLE 7 HERE---

Thus, a one-point increase in PI will decrease firm's propensity to introduce a new product by 6.6 percent on average, and by 6.3 percent in the case of process innovation. To illustrate these marginal effects, we can take as an example Angola and Botswana. Angola is one of the most politically unstable countries in Africa (WGI 4.2) and Botswana is one of the most politically stable countries (WGI 1.6). The difference between the political instability measures of these two countries is 2.6. This would indicate that Botswanan firm has a propensity to innovate that is 21 percent (2.6*0.066) higher than an Angolan firm, all else equal. The marginal effects of Government change (frequency and magnitude) are much smaller (i.e., a one point increase on this index, yields a 0.2 percent decrease in product innovation and a 0.6 percent in process innovation). In the case of BRD, 1000 extra casualties decrease the average firm propensity to introduce new product innovations with 7.8%, and respectively 10.2% for process innovation, which speaks loudly for the effect of major episodes of political instability and violence on firm innovation.

CONCLUSION AND DISCUSSION

Sub-Saharan Africa is one of the world's regions with both lowest per capita income and highest levels of political instability. While prior literature has established a robust link between instability and economic growth (Alessina and Tabellini, 1998; Darby et al., 2004; Polacheck and Sevastianova, 2012; Aisen and Veiga, 2013) little is known about the mechanisms through which this effect occurs. Previous studies have focused extensively on the interplay between political volatility and aggregated measures of foreign investments

(FDI) with very mixed conclusions (Brunetti and Weder, 1998; Li, 2006; Busse and Hefeker, 2007; Li and Vashchilko, 2010; Dai et al., 2013). On the other hand, innovation is recognized as a key driver of economic growth (Romer, 1986; Hall and Jones, 1999), and one which is contingent on the level of political stability (Waguespack et al., 2005) and institutional characteristics of countries (Courvisanos, 2009). Moreover, the engine of innovation in an economy remains the private sector (Furman et al., 2002), and therefore it is important to understand the heterogeneous effects of instability on innovating firms.

Building on a recent and growing stream of literature that examines the effects of political instability on firm performance (Guidolin and La Ferrara, 2007; Mangena et al., 2010; Abadie and Gardeazabal, 2003; Klapper et al., 2015), we focus on firm innovative performance in 15 sub-Saharan countries. Subsequently, we propose three contributions to the extant literature. First, we posit that political instability (in all forms and shapes) will bear negative effects on firms' propensity to introduce both incremental and more radical innovations, as proxied by new products/services and respectively, new processes of production. We develop several theoretical arguments (i.e., greater uncertainty regarding future demand for products, distrust and volatility of institutions, financial constraints, and scarcity of skilled human capital) through which political instability impacts negatively firm innovation. Second, we propose two moderators for this relationship, namely export orientation and foreign ownership. We argue that exporters will benefit from more stable revenue sources, increased availability of financial resources, and leaning opportunities, which will reduce the negative effects of political instability in the case of incremental (i.e., new product) innovations. Furthermore, foreign affiliation may bear both positive effects (i.e., financial and human resources, strategic advantages) but also negative ones (i.e., discrimination, nationalistic concerns), which may affect firm's innovative performance. Third, we test these conjectures using data on 3,000 firms from 15 sub-Saharan economies

that exhibit great heterogeneity both in terms of political instability and innovative performance.

Our results confirm that political instability has negative and significant effects on firms' propensity to innovate, regardless of proxies used to measure them. These effects range from 0.2 percent in the case of milder form of instability (i.e., government change) to 10.2 percent in the case of grave incidents (i.e., 1,000 additional battle-related deaths). Overall, radical innovation, as proxied by new processes, is more affected than incremental one (new products). We also find evidence that export status of firms has the potential to moderate this relationship, as exporters appear to be less affected by instability when it comes to innovation. However, the results do not support any significant difference between foreign-owned firms and domestic ones, suggesting that political instability has similar effects on both.

These results provide more robust, micro-economic evidence on the role of political instability on firm innovation, which complements prior findings at the country-level (Waguespack et al., 2005; Allard et al., 2012). Furthermore, it links theoretically and empirically firm innovative performance to the macro environment of countries (Furman et al., 2002), as a key ingredient for sustained growth in the future (Hall et al. 1999). Finally, this research focuses on sub-Saharan Africa, a region with great disparities in terms of growth and innovation rates, which lags behind other countries in terms of harnessing the power of innovation to improve living standards (Juma, 2005).

Our results bear implications for governments and managers alike. Firstly, our results confirm the critical role of political stability for micro-economic performance of firms, captured here as the propensity to introduce both product and process innovations. Given the importance of innovation for growth, and the reliance of innovation on private sector efforts, policy makers in these countries should pay greater attention to avoid unnecessary volatility in

the political arena by encouraging numerous changes of governments, or proliferating political rhetoric to instigate civil upheaval and discriminatory violence. Besides the long-lasting macro-economic implications resulting from such actions, instability will unavoidably lead to a deterioration of performance for both domestic and foreign firms alike. While exporting firms may dodge the bullet partially, the negative consequences of political instability will almost surely outweigh the scope and scale of its perceived benefits. For managers, implications are straightforward. International diversification via exports provides additional lifelines to a business that is confronted with a political instable regime at home. Nevertheless, such diversification will likely be costly and only be able to allow firms to produce more incremental types of innovations (i.e., new products and services). Radical innovations that have the potential of creating new markets and displacing competitors will remain out of reach. Yet all these conclusions must be seen as highly tentative given the limitations of this work.

Given our focus on sub-Saharan context, finding firm-level data on innovation was challenging. Thus, our study employs two subjective and binary measures of innovation, which have been employed extensively by prior literature, but are far from perfect. As a result, future work in this arena would benefit from more diversified and sophisticated measures of innovations (e.g., sales from new product/processes, actual R&D investments, domestic or international patents obtained by the firm, etc.) to check our conclusions. Such measures could also allow us to distinguish the effects of political instability on both quantity and quality of firm innovation. Next to this is the availability of innovation related questions in the ES, which has limited the scope of this research to a cross-section of 15 (out of 50) sub-Saharan African countries. Future research endeavours on African nations may benefit from recent updates in the ES by the World Bank, which could potentially allow for greater scope and dynamic effects (i.e., panel-techniques) that are currently not possible, given the existing

data. Finally, a robust finding of this study is the negative correlation between FDI stocks in these countries and firm propensity to innovate. An interesting research agenda could be developed around confirming and explaining this finding, by combining to extensive streams of literature on FDI spillovers and FDI composition in the context of sub-Saharan Africa.

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Table 1. Distribution of observations across countries and types of innovations

Country	Number of firms	Percent obs.	Product/service innovators (%)	Process innovators (%)
Angola	210	6.96%	48%	52%
Botswana	114	3.78%	58%	67%
Burundi	102	3.38%	20%	45%
Democratic Republic Congo	149	4.94%	20%	32%
Gambia	33	1.09%	64%	79%
Guinea Bissau	49	1.62%	10%	21%
Guinea	132	4.38%	8%	6%
Kenya	396	13.13%	66%	69%
Mauritiana	79	2.62%	46%	46%
Namibia	104	3.45%	50%	62%
Nigeria	945	31.32%	53%	54%
Rwanda	58	1.92%	53%	59%
Swaziland	70	2.32%	56%	59%
Tanzania	271	8.98%	56%	65%
Uganda	305	10.11%	52%	60%

Table 2. Distribution of observations across industries

Industry	Number of firms	Percent obs.	Product/service innovators (%)	Process Innovators (%)
Food	850	28.17%	54%	55%
Garments	511	16.94%	48%	61%
Textiles	67	2.22%	57%	72%
Machinery and equipment	39	1.29%	54%	62%
Chemicals	133	4.41%	68%	72%
Electronics	10	0.33%	60%	70%
Non-metallic minerals	70	2.32%	41%	49%
Wood, wood products and furniture	529	17.53%	45%	55%
Metal and metal products	322	10.67%	45%	54%
Other manufacturing	486	16.11%	95%	58%

Table 3. List of variables employed in this study

Variable	Source	Details
Prod innov	ES	Product/service innovation from the survey question: *"During the last three years, did your establishment: introduce into the market any new or significantly improved products (goods or services)?"*
Proc innov	ES	Process innovation from the survey question: *"During the last three years, did your establishment: introduce any new or significantly improved production processes including methods of supplying services and ways of delivering products?"*
PI	WGI	Political Instability and absence of violence /terrorism aggregated indicator
BRD	WDI	Battle related deaths in conflicts between warring parties in the conflict dyad
Gov. change	Center for Systemic Peace	Government changes= number of adverse regime changes times the magnitude of polity change.
Exports	ES	Total exports from two survey questions: "*In 2005, what percentage of your establishment's sales were: direct exports?*and " *In 2005, what percentage of your establishment's sales were: indirect exports?"*
ExpDum	ES	Dummy which equals 1 if export exports >1%, and 0 otherwise
Foreign	ES	Foreign ownership from survey question: *"What percentage of your firm is owned by: private foreign individuals, companies or organizations?"*
ForeignDum	ES	Dummy which equals 1 if foreign ownership >50%, and 0 otherwise.
Firm size	ES	Survey question: "*What was the total number of employees at the end of 2005(2006)?"*
Firm perf	ES	Firm performance = sales – labor costs-capital costs (land, equipment)
Rel skill	ES	Reliance on skilled human capital from the survey question: "*Do you think that the following presents any obstacle to the current operations of your establishment: inadequately educated workforce?"*
No. comp	ES	Number of competitors from the survey question *"How many competitors did you face at the end of 2005 (2006)?"*
Firm age	ES	From the survey question: "*In what year did this establishment begin its operations in this country?"*
For comp	ES	Foreign competition from the survey question "*How important is the influence of foreign competitors on your production costs"*
Mgm exp	ES	Managerial experience from the survey question: "*How many years has the top manager worked: in a managerial function in this sector"*
Gov own	ES	Governmental ownership from the survey question "*What percentage of your firm is owned by state/government?"*
No. comp	ES	Number of competitors from the survey question "*How many competitors did you face at the end of 2005(2006)?"*
Patent stock	USPTO	The number of U.S. patent applications per country between 1946 and 2004 divided by total population, then multiplied by 1000
FDI stock	WDI	Foreign direct investment stock, computed using net inflows (in current USD)
GDP pc	WDI	GDP per capita = Total GDP divided by total population

Table 4. Descriptive statistics

Variables	Mean	Std. Dev.	Min	Max
Prod innov	0.50	0.50	0	1
Proc innov	0.58	0.49	0	1
PI	3.65	0.74	1.58	5.00
BRD	0.52	0.60	0	2.43
Gov. change	18.31	12.31	0	40
Exports	5.49	17.73	0	100
ExpDum	0.15	0.36	0	1
Foreign	0.14	0.34	0	100
ForeignDum	0.11	0.31	0	1
Firm size	3.02	1.09	1.10	8.29
Firm perf	16.78	2.38	4.49	26.10
Rel skill	2.0	1.17	1	5
Firm age	2.38	0.76	0	7.65
Mgm exp	1.18	8.57	0	75
For comp	2.10	1.17	1	4
Gov. own	0.75	8.04	0	100
No. comp	3.48	0.84	1	4
Patent stock	.01	.01	0	.06
FDI stock	17.34	1.93	14.51	20.99
GDP pc	5.93	0.72	4.92	8.10

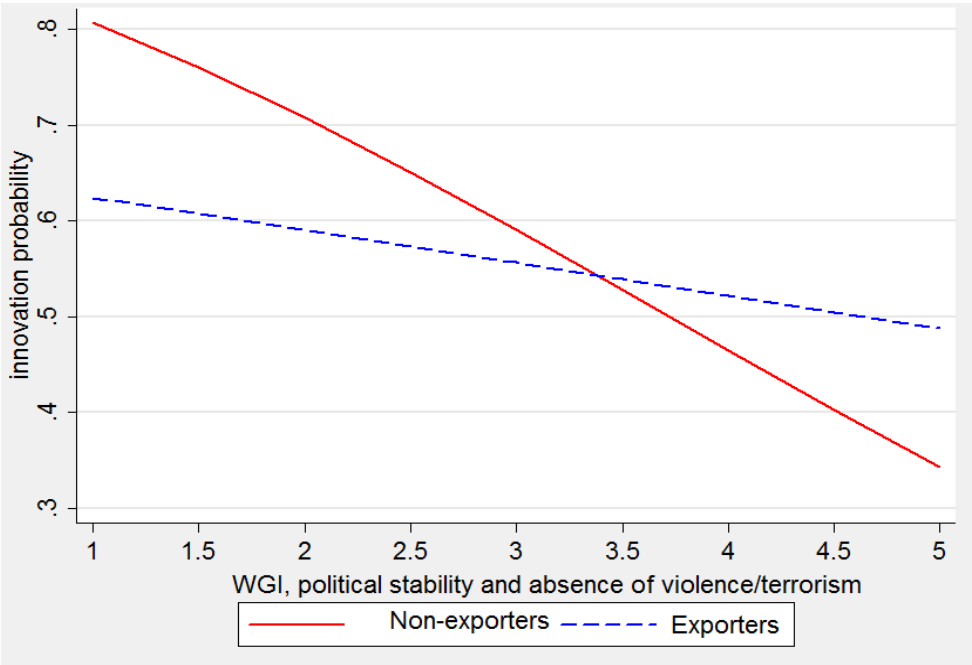

Figure 1. The moderating effect of export orientation on the relationship between political instability and new product innovation.

Table 5. Pairwise correlations

Variable	Prod innov	Proc innov	PI	BRD	Gov. change	Exports	ExpDum
Prod innov	1.00						
Proc innov	0.61	1.00					
PI	-0.11	-0.10	1.00				
BRD	-0.13	-0.16	0.61	1.00			
Gov. change	-0.11	-0.14	0.77	0.79	1.00		
Exports	0.06	0.06	-0.17	-0.16	-0.20	1.00	
ExpDum	0.12	0.12	-0.18	-0.23	-0.27	0.73	1.00
ForeignDum	0.02	0.04	-0.11	-0.04	-0.12	0.21	0.22
Foreign	0.03	0.04	-0.10	-0.04	-0.11	0.20	0.21
Firm size	0.24	0.20	-0.16	-0.19	-0.23	0.42	0.44
Firm perf	0.17	0.16	0.14	-0.22	-0.16	0.22	0.31
Rell Skill	0.09	0.07	-0.16	-0.11	-0.19	0.09	0.11
Firm age	0.06	0.04	-0.06	-0.15	-0.15	0.14	0.23
Mgm exp	0.02	0.04	-0.05	-0.08	-0.10	0.11	0.16
For comp	0.08	0.11	-0.09	-0.11	-0.18	0.17	0.18
Gov own	0.02	0.02	-0.04	-0.06	-0.06	0.08	0.06
No. comp	0.04	0.01	0.09	0.05	0.10	-0.07	-0.07
FDI stock	0.04	0.01	-0.34	-0.33	-0.55	0.13	0.13
Patents stock	0.11	0.09	-0.28	-0.40	-0.43	0.18	0.28
GDP pc	0.09	0.08	-0.64	-0.55	-0.55	0.14	0.18
	Foreign	Firm size	Firm perf	Rell skill	Firm age	Mgm exp	For comp
Foreign	1.00						
Firm size	0.27	1.00					
Firm perf	0.22	0.59	1.00				
Rell skill	0.09	0.11	0.09	1.00			
Firm age	0.08	0.31	0.23	-0.02	1.00		
Mgm exp	0.07	0.20	0.15	0.01	0.53	1.00	
For comp	0.13	0.17	0.11	0.15	0.07	0.04	1.00
Gov own	-0.02	0.13	0.10	0.03	0.10	0.03	0.03
No. comp	-0.10	-0.07	-0.05	-0.01	-0.01	-0.02	0.03
FDI stock	0.12	0.15	0.14	0.20	0.05	0.01	0.25
Patent stock	0.02	0.26	0.01	0.02	0.22	0.14	0.09
GDP pc	0.13	0.17	-0.11	0.15	0.04	0.03	0.19
	No. comp	FDI stock	Patent stock	GDP pc			
No. comp	1.00						
FDI stock	-0.15	1.00					
Patent stock	0.04	0.14	1.00				
GDP pc	-0.12	0.48	0.43	1.00			

Table 6. Political instability and firm innovation in sub-Saharan Africa: Bivariate probit estimations

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Prod innov	Proc Innov	Prod innov	Proc innov	Prod innov	Proc Innov	Prod innov	Proc innov	Prod innov	Proc innov
Firm perf	0.043***	0.069***	0.051***	0.077***	0.046***	0.076***	0.055***	0.079***	0.050***	0.077***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Firm size	0.241***	0.182***	0.224***	0.166***	0.234***	0.170***	0.240***	0.174***	0.247***	0.176***
	(0.031)	(0.031)	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.033)
Firm age	-0.018	-0.067*	-0.020	-0.069*	-0.025	-0.071*	-0.021	-0.069*	-0.025	-0.071*
	(0.038)	(0.038)	(0.038)	(0.039)	(0.038)	(0.039)	(0.038)	(0.039)	(0.038)	(0.039)
For comp	0.019	0.070***	0.027	0.078***	0.030	0.079***	0.032	0.080***	0.034	0.081***
	(0.021)	(0.021)	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Rel skill	0.070***	0.041*	0.063***	0.034	0.067***	0.035*	0.065***	0.035*	0.069***	0.036*
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Mgm exp	-0.005	0.001	-0.005	0.001	-0.005	0.001	-0.005	0.001	-0.005	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Gov own	-0.003	0.000	-0.003	0.000	-0.003	0.000	-0.004	-0.000	-0.003	0.000
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
No comp	0.088***	0.014	0.089***	0.015	0.084***	0.013	0.083***	0.012	0.079***	0.010
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
FDI stock	-0.034**	-0.058***	-0.039***	-0.063***	-0.039***	-0.063***	-0.038**	-0.063***	-0.037**	-0.063***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Patent stock	2.636*	1.976	2.685*	2.011	2.433*	1.890	2.259	1.747	2.158	1.668
	(1.440)	(1.457)	(1.441)	(1.458)	(1.462)	(1.477)	(1.467)	(1.485)	(1.489)	(1.505)
GDP pc	0.137***	0.170***	0.040	0.077	0.039	0.078	0.056	0.087*	0.049	0.085
	(0.044)	(0.044)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.052)	(0.052)	(0.052)
PI			-0.165***	-0.156***	-0.210***	-0.174***	-0.168***	-0.162***	-0.199***	-0.174***
			(0.043)	(0.043)	(0.045)	(0.045)	(0.047)	(0.047)	(0.048)	(0.048)
ExpDum					-0.991***	-0.392			-0.959***	-0.351
					(0.309)	(0.317)			(0.318)	(0.325)
ExpDum*PI					0.285***	0.112			0.280***	0.103
					(0.089)	(0.091)			(0.091)	(0.093)
ForeignDum							-0.219	-0.171	-0.037	-0.110
							(0.264)	(0.264)	(0.271)	(0.271)
ForeignDum*PI							-0.001	0.018	-0.049	0.002
							(0.073)	(0.073)	(0.075)	(0.074)
Constant	-2.077***	-1.755***	-0.907*	-0.644	-0.654	-0.553	-1.071**	-0.702	-0.850*	-0.626
	(0.367)	(0.370)	(0.477)	(0.480)	(0.485)	(0.488)	(0.486)	(0.488)	(0.493)	(0.494)
Rho	0.818***		0.819***		0.819***		0.821***		0.822***	
Observations	3,007	3,007	3,007	3,007	3,007	3,007	3,007	3,007	3,007	3,007

Notes: The measure of political instability used in these estimations comes from the World Bank Governance Indicators; All models include industry-fixed effects. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Marginal effects with different proxies for political instability

Variables	Prod innov	Process innov	Prod innov	Process innov	Prod innov	Process innov
Firm perf	0.020***	0.031***	0.015***	0.023***	0.009	0.018***
	(-0.006)	(-0.005)	-0.005	-0.005	-0.006	-0.006
Firm size	0.095***	0.066***	0.096***	0.072***	0.102***	0.079***
	(-0.013)	(-0.013)	-0.012	-0.012	-0.012	-0.012
Firm age	-0.010	-0.029*	-0.008	-0.031**	-0.011	-0.032**
	(-0.015)	(-0.015)	-0.015	-0.015	-0.015	-0.015
For comp	0.013	0.032***	0.008	0.030***	0.009	0.030***
	(-0.009)	(-0.009)	-0.009	-0.008	-0.009	-0.008
Rel skill	0.028***	0.014	0.027***	0.012	0.028***	0.015*
	(-0.008)	(-0.008)	-0.008	-0.008	-0.008	-0.008
Mgm exp	-0.002	0.000	-0.002	0.000	-0.002	0.001
	(-0.001)	(-0.001)	-0.001	-0.001	-0.001	-0.001
Gov own	-0.001	0.000	-0.001	0.000	-0.001	0.000
	(-0.001)	(-0.001)	-0.001	-0.001	-0.001	-0.001
No. comp	0.032***	0.003	0.035***	0.006	0.034***	0.004
	(-0.012)	(-0.011)	-0.012	-0.011	-0.012	-0.011
FDI stock	-0.015**	-0.026***	-0.017***	-0.037***	-0.014**	-0.025***
	(-0.006)	(-0.006)	-0.006	-0.006	-0.006	-0.006
Patent stock	0.896	0.661	0.793	-0.204	0.601	0.08
	(-0.591)	(-0.586)	-0.613	-0.612	-0.604	-0.6
GDP pc	0.018	0.032	0.045**	0.039**	0.021	0.023
	(-0.020)	(-0.021)	-0.018	-0.018	-0.02	-0.02
PI	-0.065***	-0.062***				
	(-0.017)	(-0.017)				
Gov change			-0.002*	-0.006***		
			-0.001	-0.001		
BRD					-0.078***	-0.102***
					-0.021	-0.021
N	3,007	3,007	3,007	3,007	3,007	3,007

Notes: These are marginal effects using two different probit estimations for product and process innovations in the case of Model 5 (full model) shown in Table 6 using the WGI measure for political instability (PI), the government change measure (Gov change) and the battle-related deaths (BRD) measure . Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.