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# Exchange rate undervaluation and African surges: what do we learn from exported products?

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## Abstract

We study the role of undervaluation of currency exchange rates in triggering African product export surges. Over the period 1995-2017, 96 episodes are identified for 41 African countries from a basket of their primary and manufactured exported goods (149 products, 4-digit HS code). We compute country-product specific real exchange rate misalignments, that allow testing the hypothesis that undervaluation drives competitiveness and thus export surges. The complementary log-log model confirms that product-specific undervaluation promotes the occurrence of surge episodes. This effect proves robust to the way we define export episodes, the introduction of covariates in the model, and the use of the Relogit as an alternative estimator for rare events.

**Keywords:** Africa, export surges, exchange rate, undervaluation, competitiveness, trade.

**JEL codes:** *F15, F41, F63, O11, O55.*

## Introduction:

A recent strand of the literature has shown that currency undervaluation can be a driving force of surge episodes defined as a strong and sustained increase in the growth of a performance variable. Hausmann, Prichett and Rodrik (2005), and Rodrik (2008) reached this conclusion for the GDP growth, while Freund and Pierola (2012), Eichengreen and Gupta (2013), Cadot et al (2014, 2016) showed a similar result for sectoral exports. Given the relatively small size and openness of African economies, exports are crucial, and competitiveness is a prerequisite for the structural transformation and long-term economic growth. In this paper, we use the surge identification methodology to examine African exports at the disaggregated level of export products. Our study covers all African countries for which statistical data are available, spans the period from 1995 to 2017, and focuses on their main primary and manufactured export products, a total of 149 products across 41 countries.

The contribution of this paper is on three levels. (i) First, we apply the surge literature to disaggregated exports (4-digit Harmonized System nomenclature or HS code). This method has similarities to the hypothetical-deductive framework of the double-difference method but is based on a backward reasoning. We start by identifying surges using a counterfactual. As in Freund and Pierola (2012), the performance over a seven-year period must be above the previous seven-year average, and higher than the growth rate of the world exports of the product (i.e., gain in market share). (ii) In a second stage, we identify what determines surge episodes. Our hypothesis is that production cost competitiveness, measured with respect to the main country exporters of a specific product, contributes to triggering surges.<sup>1</sup> (iii) Third, the impact of the undervaluation is tested and controlled for concomitant determinants of surge episodes by using the complementary log-log model, which accounts for the fact that export surges are rare events.

All primary and manufactured export products with annual export flows exceeding US\$ 1 million for three consecutive years are included in our study. The set of goods we consider excludes natural resource rents products-- i.e., those with an average production cost significantly lower than the international price (raw minerals, gas, and crude oil), and whose production or investment decisions are not sensitive to the undervaluation of the currency.

On average, for the 41 African countries and over the 1995-2017, exported products that we consider account for 78% for primary and for 51% for manufactured products, respectively. We identify 96 export surges over the sample, with an unconditional probability for a surge episode of 2.3%, slightly higher for primary products. The cloglog estimator suggests that country product undervaluation of the

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<sup>1</sup> In this article all references to undervaluation and real exchange rate misalignments are product-specific.

currency preceded surges. A one standard deviation increase in the level of the undervaluation increases the probability of this rare event by respectively 1.6 percentage points for primary products and 0.7 percentage points for manufactured goods, or by 22 and 11 percent, respectively, in relative terms. This conclusion is robust to changes in the parameters defining surge episodes and to the use of the Rare events logistic regression (ReLogit) estimator as an alternative to the cloglog model.

Although it has no direct implications for exchange rate policy, this empirical study provides a diagnosis of competitiveness for each of the country-product pairs exported to the African continent. It identifies the sensitivity of country specializations to relative unit production costs, and the export surge that could result from undervaluing the product's real exchange rate. Changing the nominal exchange rate is one way of influencing relative unit costs, but it is not the easiest to implement, as each misalignment is linked to a specific country-product pair. Policies to stimulate export growth focus primarily on the productive behavior of exporting companies, on their ability to reduce domestic costs and improve product quality. This productive behavior contributes to variations in the real exchange rate and to the competitiveness of a country's firms.

The remainder of the paper is organized as follows. Section 1 briefly reviews the literature on the relationship between RER and surge episodes. We then define the way we calculate our country-product exchange rates. Section 2 presents the methodology for measuring export surges and analyzing their occurrence. Section 3 focuses on the regression model of surge episodes. We discuss the choice of the estimator and the covariates to be considered in addition to real exchange rate undervaluation. Section 4 discusses the empirical results. Section 5 proposes the above-mentioned robustness checks. Finally, Section 6 draws the main conclusions and sets out some implications for economic policy.

## **I. Country-product real exchange rates, competitiveness, and export surges**

### **1. Price-competitiveness and surge episodes**

The competitiveness of export products depends on the intrinsic productivity of firms (i.e., the cost of primary factors of production), and on the price of their intermediate consumption. As shown by the World Bank's *Enterprise Surveys*, these intermediate consumptions often represent more than 60% of gross export values for most African firms (Chaffai *et al* 2012). In low-income economies with market failures and weak institutions, the higher the share of intermediate goods, the higher the transaction cost level. For example, African transport and logistics typically accounts for 15% to 20% of the value of an imported container at destination against 5% on

average in developed economies. Bribes and a poor institutional regulation add to the normal cost level of non-tradable transport services (Plane, 2021). Access to electricity is also unreliable and expensive. Low and medium voltage prices are above 10 US cents per kWh, twice as much as for Asian competitors for agricultural or manufactured products. Despite the average increase in broadband connectivity, access to Information and Communication Technologies (ICTs, thereafter) remains both limited and onerous (Chauvet and Jacolin, 2017). Given the costs of these intermediate inputs, measuring and monitoring competitiveness need to refer to a broad coverage of the prices of goods and services, including non-tradables, to proxy at best relative unit cost of production. This option is more relevant than a restrictive alternative measure focusing only on unit labor cost (Nouira et al. 2011; Gelb, 2016).<sup>2</sup> The poor quality of the business environment favors the production of non-tradables whose extra costs can be passed on consumers in case of weak domestic competition and low-price elasticity of the demand. In this context, exchange rate adjustments can be used to remove price distortions, reduce transaction costs and resulting biases on the production structure. These adjustments act as implicit subsidies benefiting all tradables.

Hausmann et al. (2005) show that surge episodes of per capita GDP are positively correlated to the currency exchange rate undervaluation. Freund and Pierola (2012) analyze aggregate exports of manufactured products and find that both undervaluation and the reduction of the exchange rate volatility account for the occurrence of surges.<sup>3</sup> Undervaluation of the currency improves national firms' intensive and extensive margins -i.e., the emergence of new products and the openness of new export markets. Eichengreen and Gupta (2013) investigate export surge episodes for both merchandise and services. Regardless of the country's level of development, the real exchange rate stimulates all exports and is particularly effective for modern services. Palazzo and Rapetti (2017) investigate the long run export performance of Argentina (1980-2015). Their results show that the highest proportion of surge episodes occurred over the period 2003-2008, when Argentina maintained a stable and competitive exchange rate that benefited labor-intensive industries the most. Guzman *et al.* (2018) also argue that a Stable and Competitive Real Exchange Rate (SCRER) has a positive impact on the development of tradables. By reducing uncertainty, it spurs apprenticeships and help to cope with high fixed or sunk cost investments. More recently, Ebeke (2023) examines the determinants of surges in Global Value Chains (GVC) participation of developing countries. He finds that surges are rare in sub-Saharan Africa, typically preceded by strong FDI inflows and

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<sup>2</sup> In some countries real wages may be high given the low productivity level or tight market conditions on some segments of the supply. Gelb *et al.* (2016) mention such a situation for specific middle manager jobs or skilled workers whose supply lags far behind productive sector needs.

<sup>3</sup> At an HS 6 level of disaggregation, Cadot *et al.* (2014) focus on export surges in bilateral trade flows for 8 developing countries over the period 1995-2012.

good governance, while prolonged real exchange rate undervaluation facilitate their occurrence.

## 2. Measuring product-specific exchange rate undervaluation

The Purchasing Power Parity (hereafter PPP) criterion, adjusted for the country's productivity level, sheds light on the implicit profitability of exports. Assuming that the price of a 4-digit HS code product is the same for all producers (i.e., the law of one price), an undervaluation of the currency vis-à-vis the main world exporters of the product reflects more or less competitiveness, let say the difference in the relative unit cost of production of the exported product. We define RER as the ratio of the PPP conversion factor in domestic currency to the official exchange rate (ER) (i.e., number of national currency units per U.S. dollar).

$$RER_{ct} = \frac{PPP_{ct}}{ER_{ct}} \quad (1)$$

We use ratios distributed over the 0-1 interval from the World Bank's *World Development Indicators* with the upper bound reflecting the value for the United States, the common reference for all countries. Misalignments are therefore benchmarked by the US dollar, implicitly supposed to be at the equilibrium exchange rate level.

For a country (c) a ratio lower than unity in year (t) means an undervaluation insofar as the domestic purchasing power of the currency turns out to be higher than what the official exchange rate indicates. These ratios are then adjusted for the impact of the productivity level of tradables on the price of non-tradables (Balassa - Samuelson effect). For this adjustment, RERs ratios are regressed on per capita GDP levels by considering a worldwide sample that includes high income level economies. Regression residuals provide by-country yearly misalignments that approximate the deviation to the long run international convergence rule of non-tradable good prices.

In absolute PPP terms, most African currencies are undervalued against the dollar, and remain so after adjusting non-tradable prices for productivity differences. Specialized in a limited number of products, often with a low level of processing, African economies do not compete with US exporters on most product markets. Therefore, by product (p) and for year (t), competitiveness is calculated by the difference between the misalignment of the currency (c) and that of the ten largest trading competitors (j) on the (p) product, each weighted by its average contribution into the product's world exports over the period 2009-2013 ( $\rho_j$ ). The set of ten largest exporters of both primary and manufactured goods represents 72 percent on average, with a minimum of 52 and 42 percent respectively for each category. This coverage

appropriately reflects global conditions of production of the product (p). Let's briefly summarize the two steps involved in calculating exchange rate misalignments.

First, we conduct the regression below using OLS estimation over the largest country sample and estimate yearly country misalignment from its residuals ( $u_{ct}$ ). We do not include country fixed effects, following Rodrik (2008), Couharde and Sallenave (2013) or Ribeiro et al (2020). This econometric estimation only aims to remove the long-run impact of productivity on the relative price of non-tradables from the RER. The joint introduction of country fixed effects and GDP per capita (GDPPC) would pose an identification problem since fixed effects are often viewed as a proxy for productivity (Cornwell, Schmidt and Sickles, 1990).

$$\log(RER)_{ct} = \alpha + \beta \log(GDPPC)_{ct} + f_t + u_{ct} \quad (2)$$

With  $f_t$ , year-fixed effects; and  $u_{ct} < 0$ , undervaluation or  $u_{ct} > 0$ , overvaluation.

Second, from the misalignments as determined by the above regression, for a product (p) and a country (c), we calculate the misalignment in year (t) as follows,  $\rho_{jp}$  being the share of the  $j$ -th trading competitor in worldwide exports of this specific product.

$$Misalignment_{cpt} = [u_{ct} - \sum_{j=1}^{10} \rho_{jp} u_{jt}] \quad (3)$$

Misalignments are calculated under assumptions close to those used in price level PPP theory. (i) By assuming that the law of one price holds for each tradable, misalignments mainly result from non-tradable prices or differences in the taxation of imported goods. (ii) In the absence of any specific information, the country productivity for a given product is supposed equal to that of the average economy, as reflected by the per capita GDP. The concept of "misalignment" used in this study is product-specific and has no normative implication for the equilibrium exchange rate, which is based on macroeconomic performance as measured by the country's internal and external balances (Plane and da Piedade, 2021). In other words, a country may experience undervaluation relative to some export products and an overvaluation for others, while keeping a global macroeconomic equilibrium. Each product-specific exchange rate misalignment depends on each country's competitors in the world market for the product. Our analytical approach has therefore no direct implication on how appropriate the real exchange rate is for the economy as a whole.

## II. Measuring export surges and assessing their occurrence

### 1. The method for identifying surges

We define  $v_{c,pt}$  as the value of exports of product  $p$  at constant price for a country  $c$  at time  $t$ , and the real growth rate of product exports:  $g_{c,p,t} = \Delta \ln(v_{c,pt})$ . To deflate nominal exports, we use the weighted unit export value of the product's ten largest exporting countries. Initiation is the first year of a seven-year period of a specific product export surge (i.e., Take-off phase). Let  $g_{c,p,t}^1$  and  $g_{c,p,t}^0$  denote, respectively, be the average annual growth rate of the real export over the seven-year take-off, and the pre-acceleration growth rate in the previous seven-year period. Briefly, the identification of an export surge episode relies on the joint application of four criteria:

**Criterion 1.** The average real export growth of the product during a seven-year take-off phase must be strong and higher than the world average real growth.

$$g_{c,p,t} > \overline{g_p} \quad (4)$$

Freund and Pierola (2012) deflate exports at current prices by the US consumer price index (CPI). This option is questionable at the sectoral level and even more so at the product level. Each tradable good has its own price evolution affecting the occurrence of a surge differently from what is assumed using the US consumer price index. Moreover, US retail prices depend on the productivity and the labor market conditions of this economy. To get values at constant prices, assuming the law of one price, the most relevant option is to use the specific export-product price. Accordingly, we deflate export value by the unit value index as determined from the ten major worldwide exporters of the given product over 2009-2013.

**Criterion 2.** The average real growth during the take-off phase must be 30% higher than that of the seven-year reference period ( $\alpha = 1.3$ ), and at least three percentage points higher than that of a seven-year reference period ( $\beta = 0.03$ ).

$$g_{c,p,t}^1 > \alpha \times g_{c,p,t}^0 \quad \text{And} \quad g_{c,p,t}^1 > g_{c,p,t}^0 + \beta \quad (5)$$

**Criterion 3.** The minimum value of real exports during the take-off period should be higher than the maximum pre-take-off value in order to filter out surge episodes resulting from volatility phenomena of the export volume.

$$\min(v_{c,pt}, \dots, v_{c,p,t+6}) > \max(v_{c,pt-7}, \dots, v_{c,p,t-1}) \quad (6)$$

**Criterion 4.** The average post-take-off growth calculated by eliminating the year of highest growth must be higher than the average pre-take-off growth (See criterion 2;  $\alpha \times g_{c,p,t}^0$ ). This criterion eliminates accelerations that would depend on a single year of strong export growth.

$$g_{c,p,t}^1 \setminus \{ \max (g_{c,p,t} \dots, g_{c,p,t+6}) \} > \alpha \times g_{c,p,t}^0 \quad (7)$$

This export surge measurement has three important features:

(i) First, the surge episode is by no means a single measure of the performance. A country that experiences a high but steady export growth on a product does not induce a surge although the growth can be far above that of the world economy. Onset surges are predicated on clear breaks from past export performance conditions.

(ii) Second, the number of exported products per country is set at a maximum of ten, respectively 5 primary and 5 manufactured products, the most important export products for each of the two categories. Including manufactured goods is justified not so much by their current, and limited, share in African exports but by their expected contribution to structural transformation (Rodrik, 2018). The composition of the basket of international partners is constant and the choice of products is based on the structure of exports over the period 2009-2013. Accordingly, we mainly center the performance on the intensive margin. Since we refer to the aggregate exports of the product on the world market, the extensive margin is only implicitly present through the potential opening of new markets.

(iii) Third, the limited number of selected products is appropriate for most African countries. It is only restrictive for a small number of large and more developed economies. The underestimation of export surges is likely for North African countries. This limitation avoids overrepresentation of some large middle-income economies within the sample.

## 2. The database and the occurrence of surges

We use the BACI database (CEPII), built from data reported to the United Nations Statistical Division (Comtrade) and include all African countries with available products exports data. Our sample is constituted of a three-dimensional panel of 41 African countries and 149 products (4-digit HS code) exported over the period 1995-2017. To be considered, a product must have been exported consecutively for at least three years during the period and represent an average export flow of at least one million dollars. We exclude some raw materials - i.e., crude oil, gas and minerals, as well as products of chapter 27 and chapters 84 and 86 to 89 of the HS 4

nomenclature. Export products of chapter 87 are considered for only 6 countries: Algeria, Egypt, Morocco, Nigeria, South Africa, and Tunisia. For the other African countries, these chapters account for either imported goods that are re-exported in neighboring countries (mirror data only provide an imperfect correction of such trade), or sales of secondhand products (e.g., helicopter reexports by Gabon, HS-8802).

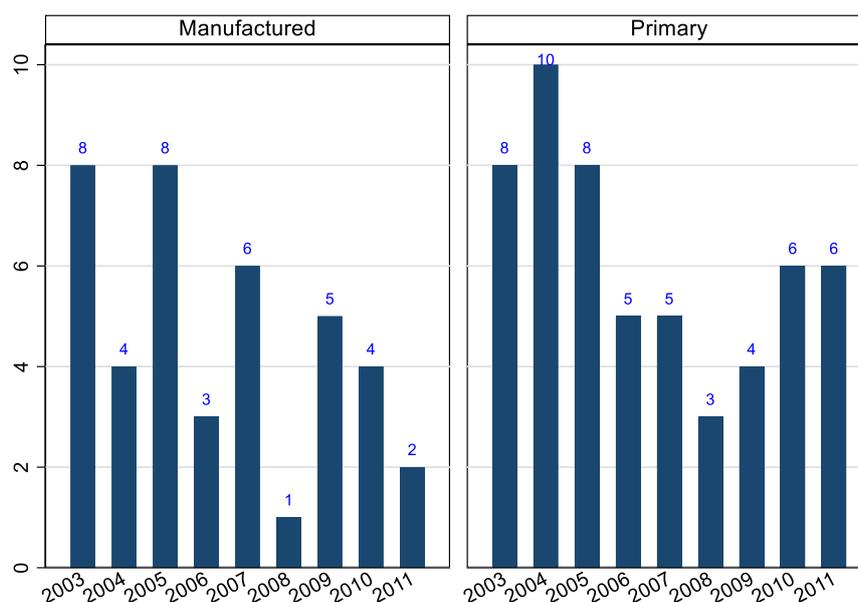
By major African regions, Table A1 in Appendix 1 displays the contribution of the 5 selected products for primary and manufactured goods, respectively. Countries in brackets are those with the lowest and highest percentages in the regional subset considered. Products were selected on the basis of the export value in their sectoral category over the period 2009-2013. On average, the top 5 primary product exports, excluding crude oil, gas and minerals, account for 78% of the category over the 41 sampled African countries, ranging from 32 % (Egypt) and 100 % (Cabo Verde, Chad, Comoros, Central African Rep, Equatorial Guinea, Guinea-Bissau). Percentages vary across African sub-regions from 53% (Northern Africa) to 92% (Central Africa). For manufactured exports, the top five products account for 51% on average, ranging from 0,45% (Liberia) to 100 % (Mauritania). The selected manufactured products typically represent a smaller fraction of exports than primary ones.

Applying the set of previously mentioned criteria to primary and manufacturing products yields 96 episodes of export accelerations over 2001-2011. Figure 1 shows when export surges occurred and Figure 2, their geographic distribution by product in Africa as well as their weight in the export basket (Appendix 2). The earliest surge can only occur in 2001 (1995+6 years) and the latest in 2011 (2017-6 years). In fact, the first event dates back to 2003. Among the 96 episodes, 55 fall under the category of primary products, and 41 to manufactured products. Export surges are more frequent before the subprime crisis (2008) and the post subprime profile proves better for primary products, in relation with the Chinese economic growth, at least until 2010. The years beyond were much less stimulating with a Chinese GDP growth that fell from 10.6% in 2010 to 6.9% in 2017. To put it another way, although African market shares are very small for most manufactured goods, when the world economy slows down, it proves difficult for a country to increase its market share, one of the conditions for a surge episode to occur (Criterion 1).

Figures 3 and 4 refer to export surges by product. For primary goods, cashew nuts (HS-0801) come first with 7 episodes. This economic specialization is present in ten African countries, especially in West Africa. Vietnam is the world's largest processor ahead of India. It imports a lot from Côte d'Ivoire but is promoting a policy of setting up operations in nearby countries. Cocoa beans (HS-1801) follow with 6 episodes. Ghana and Côte d'Ivoire are the most important worldwide producers, with

a combined market share of about 60 %. Natural rubber (HS-4001), and fruits (HS-0804) then come with 4 episodes each. Turning to manufactured products, 3 export surges are accounted for in both Portland cement (HS-2523) and transport articles (HS-3923). The first product reflects the African dynamics of investments in both infrastructure and housing. Both sectors have benefited from the so-called “supercycle” of raw materials that fueled the economic growth of a wide range of African countries.

**Figure 1: Africa and the timing of surge episodes (by category, number of products)**

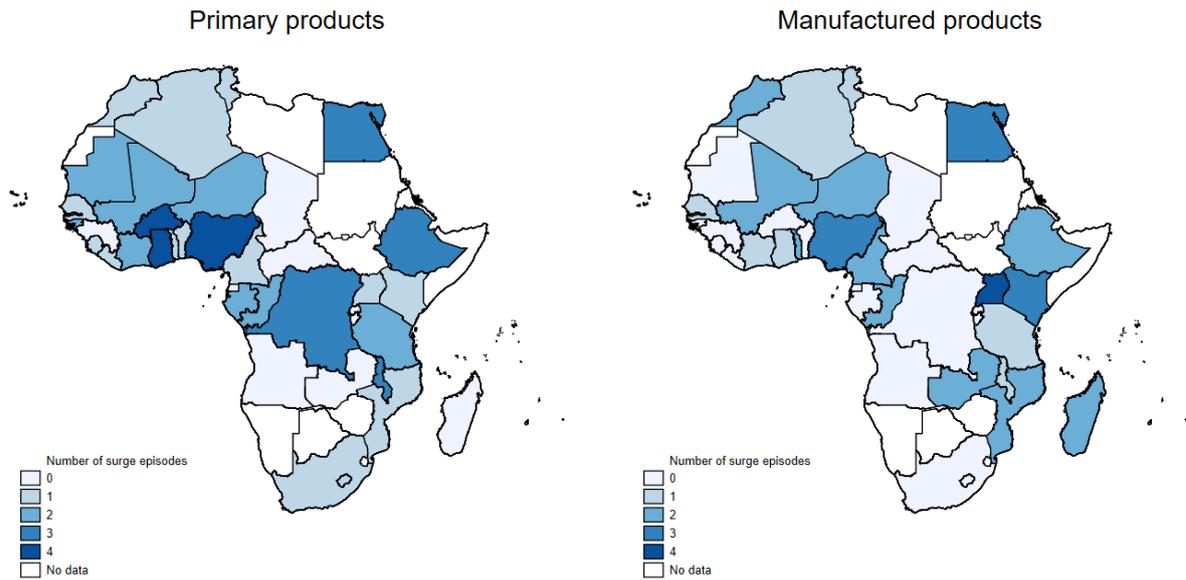


Source: BACI 2019

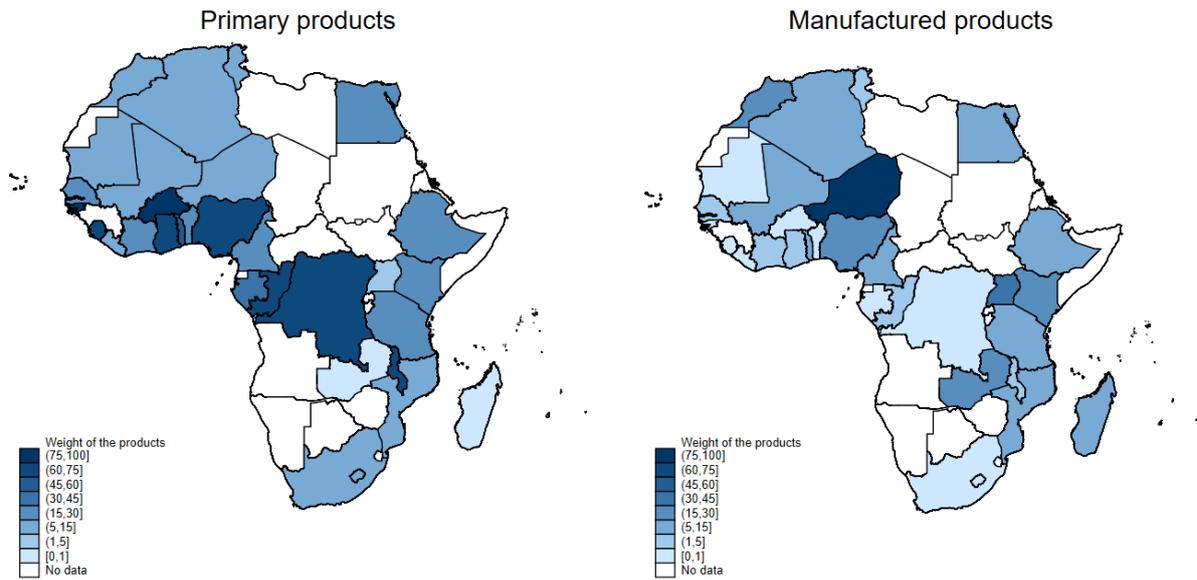
Source: BACI, 2019 and Authors’ calculations.

Table 1 lays out the unconditional probabilities of surges by type of products, per capita income levels, and regions. The occurrence of events is calculated over the total number of country-product-year observations for which an acceleration can potentially take place. As we focus on onset surges, the six years following the start of the episode are excluded. This is also the case for the years before 2001 and after 2011

**Figure 2: Geographical distribution of Export surges**  
 Number of surge episodes

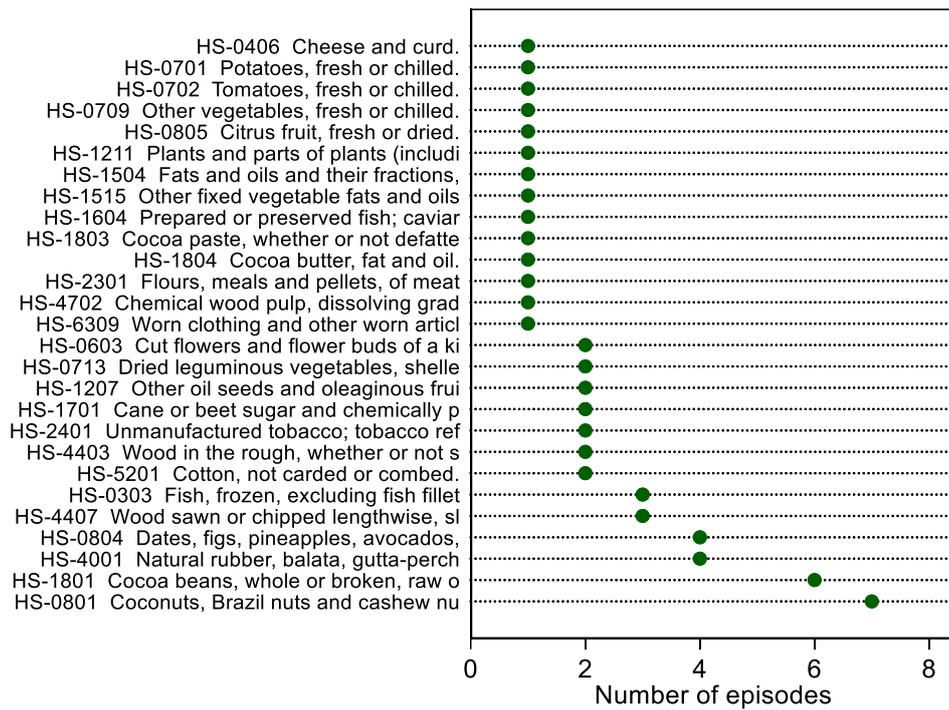


**Percentage of product surges among all products considered for each category (%)**



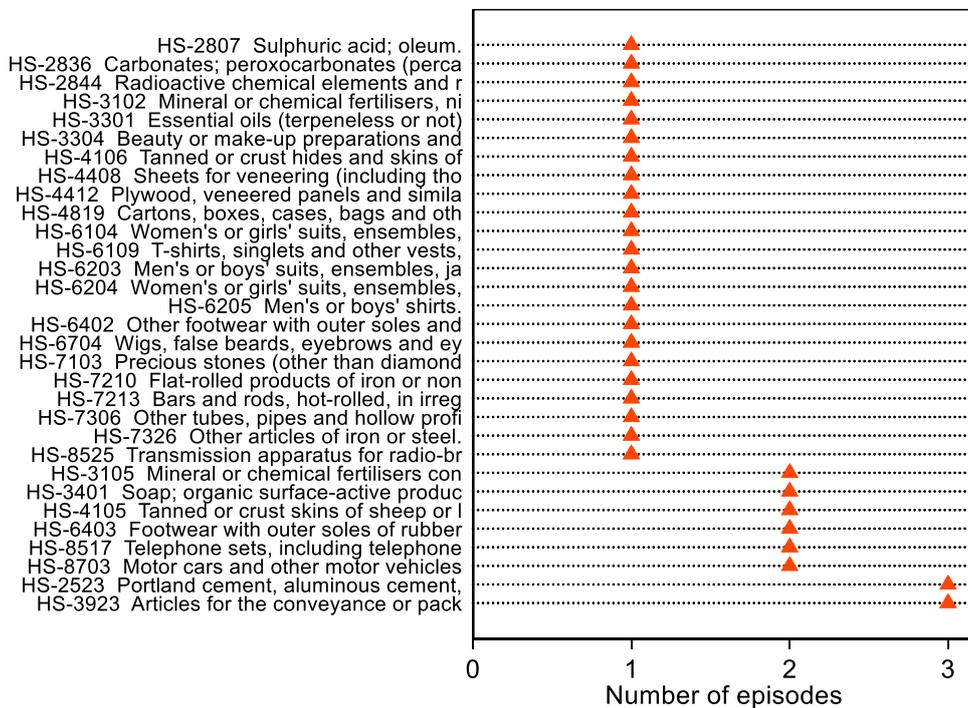
Source: Authors' calculations.

**Figure 3: African export surges: primary products (2001-2011)**



Source: Authors' calculations

**Figure 4: African export surges: manufactured goods (2001-2011)**



Source: Authors' calculations.

where no surges are possible due to the defined event time span. We breakdown the whole period into two sub-periods separated by the subprime crisis starting in end 2007 with the U.S. housing bubble and the global financial crisis.

**Table 1: Unconditional probabilities of surges**

	2001-2007	2008-2011	2001-2011
Overall probability	2,5%	2,1%	2,3%
<i>By type of products</i>			
Primary	2,6%	2,4%	2,5%
Manufactures	2,3%	1,7%	2,1%
<i>By geographical regions</i>			
Southern Africa	0,5%	1,7%	0,9%
Northern Africa	3,9%	1,3%	3,0%
Central Africa	2,6%	0,4%	1,8%
East Africa	2,9%	1,4%	2,4%
West Africa	2,1%	3,5%	2,6%
<i>By per capita income quintiles</i>			
1st quintile	0,6%	2,2%	1,1%
2nd quintile	1,4%	2,6%	1,7%
3rd quintile	3,5%	1,8%	2,8%
4th quintile	3,8%	2,3%	3,2%
5th quintile	3,7%	1,5%	2,8%

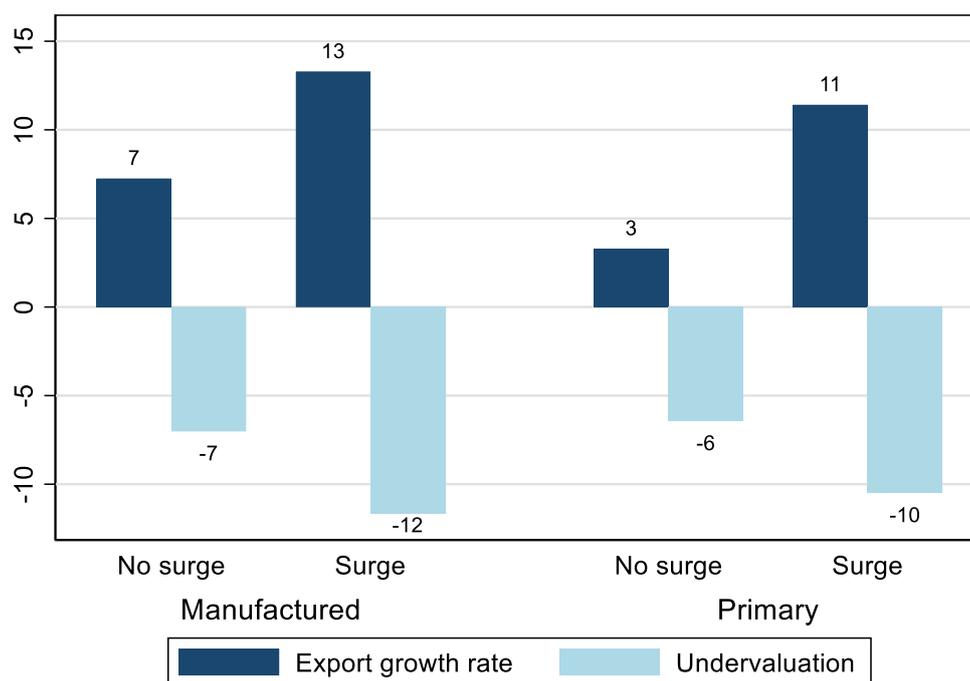
Source: Authors' calculations.

Over the whole period, the unconditional probability that an export surge occurs is 2.3%, with a higher probability for primary than manufactured products. An analysis by sub-regions shows that the occurrence of surges in North African countries is three times higher than in Southern Africa. Central Africa is particularly affected by the post 2007-2008 crisis, the unconditional probability of acceleration falling from 2.6% over 2001-2007 to 0.4% after 2008. The lower part of Table 2 classifies export surges by quintiles of the per-capita income level of sampled countries. The first and second quintiles are less likely to experience an export surge than those from the third to fifth quintiles. Cerra and Woldemichael (2017) evidence similar results for more aggregated exports. This may reflect the fact that high-income countries are more successful in promoting manufactured exports. The diversification process is more difficult for low-income African agricultural exporters. Given the concentration on primary products where African market shares are non-negligible, it is more difficult to initiate export accelerations in manufactures.

How does export performance fit with exchange rate misalignments? Descriptive statistics provide interesting preliminary information. In Figure 5 we compare all country-product pairs with an undervaluation according to whether or not they experienced export surges over the period 2001-2017. Firstly, undervaluation goes hand in hand with higher export growth for both primary and manufactured

products. Secondly, country-products surges provide higher export growth rates. Thirdly, the country-product export gains associated with export surges are significantly higher in the case of primary products. The average annual export growth rate over the 2001-2017 period rises from 3 % in the absence of export surges (with an average undervaluation of 6 %) to 11 % in the case of export surges (undervaluation of 10%).

**Figure 5: Average variation in undervaluation and export growth: by product categories according to the presence or absence of surges episodes (Period 2001-2017, exports at constant prices, in %)**



N.B. Given the time span referenced in the surge definition (7 years), surges are only observable from 2001 onwards over the sample period (1995-2017). Average annual growth rate of exported products is unweighted.  
*Source: Authors using BACI 2019.*

### III. Predicting surges and identifying their determinants

Given that an export surge is a rare event, our binary dependent variable model is characterized by a preponderance of zeros. The data then suffers from a class imbalance problem. In this case, standard probit and logit estimators provide biased results toward zero. To account for the structure of the sample, we use the complementary log-log (cloglog) model. The cloglog is related to the gompit model. It differs from the logit and the probit by its non-symmetric transformation, which

allows an appropriate treatment of rare events. The formal specification of the cloglog model is as follows:

$$\Pr (ES_{c,p,t} = 1 | X_{c,p,t}) = F(\beta X_{c,p,t}) \quad (8)$$

Where  $F(\mathbf{z}) = 1 - \exp\{-\exp(\mathbf{z})\}$ ,  $ES_{c,p,t}$  is a dummy variable that is equal to 1 in case of export surge (ES) for a country (c), product (p) at year (t), and zero otherwise.  $X_{c,p,t}$  is a set of controls.

Taking up the approach of Hausmann (2005) and more recently Libman (2019), we rule out the uncertainty about the starting year of an export surge by centering the dependent variable over a three-year window around the initiation year ( $t-1, t, t+1$ ). Given the way the filter parameters are defined (See section II.1), surge episodes cannot happen over the first and last seven-year spells. In addition, as a beginning of an acceleration is detected, observations from  $t + 2$  to  $t + 6$  are removed from the sample. By doing so we focus on the starting years of the country-product-episode. In other words, the sample only includes the three-year window for country-export-episodes, but the whole period in case of no country-export-product surge (control group).

Because of data limitations, this cross-sectional analysis does not control for all relevant export growth factors such as imported inputs. An exchange rate shock may make the firm more competitive due to local value-added content, but also increase the cost of imported inputs. This information however is not available. Other factors may also be not statistically significant over the whole country-product pairings. For example, the growth of cashew nut exports (HS 0801) from Africa may result from rising competitiveness, but also relates with rising climatic constraints in their Asian competitors.

Table 2 provides descriptive statistics for the main variables included in the regression analysis. The undervaluation level is the variable of interest. Over the period 2001-2017, its average level over the sample is 7.4%. To have an appropriate estimation of its coefficient we introduce a set of controls denoted  $X_{c,p,t}$ . These variables are measured as average over the seven-year period preceding the surge. Controls range into two categories: country related variables, generally with a limited variance over time, and specific country-product variables that are related either to the international or the domestic environment.

## 1. Country related variables

As is customary when conducting sectoral or aggregate export analyses, we introduce indicators reflecting time variant development levels (Fernandes *et al.*, 2016). A higher *per capita GDP* goes hand in hand with better established and larger firms, which have a higher ability to seize international market opportunities. Real per capita GDP is expected to be positively correlated with export surges, probably more for manufactured than for primary products. We posit a potential non-linear effect that we simply test through a quadratic-type relationship as generally the case for aggregate exports (Klinger and Lederman 2006, Parteka 2007, Cadot, Carrère and Strauss-Kahn 2011).

*The secondary education index* is incorporated in the regression to assess the role of human capital through the productivity level. A positive effect is expected for all types of products. This index is preferred to the primary enrollment rate which discriminates less across African countries.<sup>4</sup>

*The Exchange rate classification scheme.* In order to provide a broad picture of underlying impacts of exchange rate arrangements, we use three aggregated classes from the de facto exchange rate arrangement classification (Ilzetzki *et al.*, 2019). The first category is for pegged (or related) exchange rate regimes. The second class is for intermediary systems based on all crawling peg options (codes 2 and 3). The third and last category gathers all exchange rate floating systems (codes 4 to 6). A pegged regime may provide more stability on expectations about the macroeconomic policy but may result in rigidities or foreign exchange shortages constraining the tradable sector. Intermediate and floating exchange rate systems may offer more flexibility, but possibly at the cost of more uncertainty and less credibility of macroeconomic policy. The independence of monetary and fiscal policy increases, but at the cost of the volatility of the nominal exchange rate finally creating a “fear of floating” (Calvo and Reinhart, 2002).

*Domestic conflicts.* Since the early 2000s, rebel and self-defense militias as well as various groups affiliated to Islamic jihad organizations erode North and West African states. For this region alone, Trémolières *et al.* (2020) counts no less than 3 700 violent events for 2018. Conflicts in the Lake Chad caused 68 000 victims since 2009. Civil wars in Sierra Leone (1991-2002) or Côte d’Ivoire (1999-2010) have had repeated negative impacts on cocoa exports and disincentivized investment in manufactured production. This bleak picture contrasts with the first decade of the 2000s, when African civil wars declined to half of their mid-1990s levels (Straus, 2012). We expect that the end of a conflict stimulates export catch-up phases whose effects may potentially correlate with real exchange rate changes. To identify the impact of domestic political disturbances or upheavals, we consider the weighted conflict index

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<sup>4</sup> SE Index is a subindex of the FERDI’s Human Assets Index (HAI) retrospective series. See Feindouno and Goujon (2019).

of the Cross-National Time Series (CNTS) from EUI (European University Institute). The CNTS combines 9 broad items using data coming from the *New York Times*. The dataset records occurrences of events and weights them according to gravity: general strikes, purges, government crises, riots, assassinations, anti-government demonstrations, as well as events with the highest weighted factors: guerilla warfare, and revolutions (Banks and Wilson, 2015). This conflict index ranges from zero (peaceful domestic environment), to 15.28 (highest intensity of conflict). We hypothesize that domestic conflicts are negatively correlated with export surges.

## 2. Country-product related variables

As mentioned earlier, the main innovation of this paper is to highlight the role that exchange rate undervaluation plays in product-specific export surges. An African cashew producer is indirectly affected by the macroeconomic exchange rate misalignment, but directly by its unit cost, *vis-à-vis* other cashew producer countries.

The misalignments are obtained from the regression bellow, based on the largest worldwide sample of countries to seize the long-run average impact of productivity on the price of non-tradable goods. Based on 176 countries that we consider over the period 1995-2017, this panel provides information about misalignments for all national currencies *vis-à-vis* the US dollar.

$$\text{Log}(\widehat{REER})_{ct} = \frac{0.224^{***}}{(0.003)} \log(\text{Per capita GDP})_{ct} - \frac{2.767^{***}}{(0.03)} \quad (9)$$

$R^2 = 0.48$ ,  $n = 176$  countries,  $t = 1995$  to 2017. Standard error in parentheses

The coefficient on the regression of GDP per capita is quite close to that identified by Rodrik (2008). For a specific country-product pair, the exchange rate misalignment is measured by the difference between the country's residual and the weighted average of those of the ten largest competing countries on the product. From the distribution of real exchange rate misalignments, only observations with an undervaluation are retained, meaning that when this event does not occur, the observation is equal to zero. The underlying assumption is that, on average, overvaluation is unlikely to lead to export surges. The inclusion of overvaluation as an additional variable in the regressions proved to be statistically insignificant, with no impact on the specific coefficient of undervaluation.<sup>5</sup> We now extend the information space to additional controls that combine country, product and time.

**Market shares.** These are measured on an annual basis by a country's exports of a specific product (p) in world exports of that product. The impact of this variable is ambiguous. In the case of primary agricultural products, African market shares can be large, as is the case for Ghanaian and Ivorian cocoa, which reduces the probability

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<sup>5</sup> Results incorporating the overvaluation variable are provided in Appendix 3.

of export surges. Turning to manufactured products, a well-structured marketing and distribution network make it easier to increase export sales in a context where initial market shares are still low. When fixed and sunk costs are partly covered, mature countries have a better resilience to unforeseen events. Accordingly, within a sample restricted to African countries, we suppose that market shares are positively correlated to surge episodes of manufactured goods.

***The relative number of Internet users per 100 inhabitants.*** Digital infrastructure is an efficient means to reducing transaction costs and informational issues. As such, the Internet enables productivity gains, supports business performance, and improves economic governance (Paunov and Rollo, 2015, 2016; Cariolle et al., 2019; Asongu and Nwachukwu, 2016). Hjort and Poulsen (2019) evidence the economic implications of the broadband Internet in African countries. Using data from the World Bank *Enterprise Surveys*, they show that this technological change has led to a rapid development of direct exports, in particular due to the greater fluidity of relations with foreign customers and the use of online communication between firms in customer-supplier relationships. Similarly, Cariolle and da Piedade (2023) show that increased digital connectedness leads to greater sophistication (complexity) of exported goods, particularly in Africa. Internet also enlarges the size of the formal sector and attracts foreign direct investments that are generally found to be a powerful channel to drive the diversification of exports (Freund and Weinhold, 2004, Jacolin *et al.*, 2021). Access to ICTs is very uneven across Africa. For a country, it is assumed that the competitive position depends on the evolution of the gap with competing countries. So, we construct an indicator of the internet access for each country-product pair. We test the relative impact of this variable using the same subset of exporting competitors and weights as for exchange rate misalignments. In other words, as the set of competing countries is product-specific, this relative variable varies with country's export products. We posit a positive relationship between Internet access and export surges.

***Relative Corruption index.*** Bribes and a weak governance can be akin to a tariff, discouraging international transactions by increasing costs (Anderson and Marcouiller, 2002). To investigate the role of this variable we compute the relative corruption index using Standaert (2015)'s Bayesian Corruption Index (BCI) and the same methodology as for the relative number of Internet users. By the relative corruption index, we compare the country's BCI to that of its competitors on the same export product. Thus, the resulting measure reflects the difference in the quality of institutions and the implications for transaction cost levels. An increase of this relative index means a less market-friendly environment.

**Table 2 Descriptive statistics of export surge determinants (2001-2017)**

Variables	Obs	Mean	Standard deviation	Min	Max	Sources	Expected signs
Export Surges (=1, dummy)	4090	0.07	0.256	0	1	BACI	
Market share (in %)	6416	1.925	5.528	0	67.84	BACI	-/+
Undervaluation (in %)	6416	-7.4	16.4	-127.7	0	Authors	-
Overvaluation (in %)	6416	18.5	20.3	0	110.8	Authors	-
Log (per cap GDP)	5920	7.016	1.055	5.267	9.92	WDI	+
Log (per cap GDP) <sup>2</sup>	5920	50.343	15.615	27.743	98.407	WDI	-
Relative Internet users	6416	-29.413	21.175	-82.322	24.725	WDI	+
Log (Secondary education)	5091	3.224	0.961	-2.323	4.605	HAI-FERDI	+
Relative Corruption index	6416	0.8	0.722	-0.732	3.357	<i>Standaert (2015)</i>	-
Conflict index	5470	0.161	0.865	0	15.281	CNTS	-
Pegged regime	6048	0.406	0.491	0	1	<i>Ilzetzki et al. (2019)</i>	-/+
Intermediate regime	6048	0.561	0.496	0	1	<i>Ilzetzki et al. (2019)</i>	-/+
Floating regime	6048	0.033	0.179	0	1	<i>Ilzetzki et al. (2019)</i>	-/+

NB: for surge episodes, the dummy takes the value one. These descriptive statistics are given for the entire sample, including both primary and manufactured products. The correlation table is provided in Appendix 1. Source: Authors' calculations. HAI, Human Asset Index; WDI, World Development Indicators, World Bank. The BACI database is from CEPII.

## IV. Regression results

### 1. Determinants of export surges (take-off)

Table 3 provides a set of econometric relations between the onset of surges and currency undervaluation vis-à-vis major country-product competitors. Cases other than undervaluation have a value of zero. The coefficient of interest is controlled or not by regional dummies. Columns distinguish aggregated from by-sector results. The expected negative sign is obtained in all cases, which means that undervaluation, a negative value, stimulates export surges. Only in column 3 does the cloglog model fail to give statistical significance at the conventional confidence levels.

**Table 3: Baseline regression: Onset of export surges (2001-2012)**

	(1) All	(2) All	(3) Primary	(4) Primary	(5) Manuf	(6) Manuf
Undervaluation	-0.047*** (0.018)	-0.070*** (0.018)	-0.044 (0.030)	-0.071*** (0.027)	-0.050** (0.021)	-0.064*** (0.022)
Southern Africa		-0.086*** (0.023)		-0.108*** (0.039)		-0.066** (0.026)
Central Africa		-0.023 (0.015)		-0.003 (0.020)		-0.043** (0.021)
East Africa		0.001 (0.014)		-0.011 (0.020)		0.011 (0.017)
West Africa		0.005 (0.013)		0.033* (0.017)		-0.028 (0.017)
Observations	4,090	4,090	2,150	2,150	1,940	1,940
Number of surges	96	96	55	55	41	41

Notes: Cloglog estimates. The regression coefficients are marginal effects. The dependent variable is the dummy variable equal to 1 over a 3-year window centered on the onset date of the surge. Standard errors are adjusted for clustering at the product-year level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

In Table 4, these initial results prove robust to the introduction of the set of controls. Several of them are relevant with some variations depending on product categories. For primary products, the relative corruption and the secondary school enrollment are significant as well as the exchange rate regime. It appears that both pegged and intermediate exchange rate regimes outperform the floating regime, the reference category in the regressions. Manufactured goods prove sensitive to the number of Internet users. This expected result fits with what Huang *et al.* (2018) and Huang and Song (2019) or at the provincial level, Fernandes *et al.* (2019) found for Chinese firms' probability to export. It is also in line with Hjort and Poulsen (2019) who show, for Sub Saharan African countries, that access to a fast Internet connection has increased firm entry, productivity, and exports.

Surprisingly, the impact of the relative corruption index is weaker in the case of manufactured goods than for primary products, at odds with the "sand in the wheel" hypothesis of the corruption-trade linkage literature (Anderson and Marcouiller, 2002). In a context of acute external competition with low firm profit margins, corruption is an additional obstacle for export surges. One potential reason for this weak correlation is that the so-called impact is already captured by other controls, especially those reflecting the development level (per capita GDP, Secondary education, Internet users, etc).

**Table 4: Regression results with covariates: onset of export surges (2001-2012)**

	(1) All	(2) All	(3) Primary	(4) Primary	(5) Manuf	(6) Manuf
Log (Per cap GDP)	0.031 (0.068)	0.084 (0.068)	-0.082 (0.100)	-0.062 (0.099)	0.163** (0.082)	0.269*** (0.083)
Log (Per cap GDP) <sup>2</sup>	-0.004 (0.005)	-0.008* (0.005)	0.004 (0.007)	0.003 (0.006)	-0.013** (0.006)	-0.021*** (0.006)
Log (Secondary education)	0.022*** (0.005)	0.023*** (0.006)	0.031*** (0.007)	0.030*** (0.010)	0.014** (0.007)	0.011 (0.007)
Undervaluation	-0.072*** (0.020)	-0.073*** (0.018)	-0.078** (0.038)	-0.090** (0.035)	-0.054** (0.022)	-0.040** (0.020)
Market share	-0.001* (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.002 (0.002)	-0.002 (0.002)
Relative Internet users	0.001** (0.000)	0.001** (0.000)	0.001 (0.001)	0.001 (0.001)	0.001** (0.000)	0.001** (0.000)
Relative Corruption index	-0.020*** (0.007)	-0.018** (0.008)	-0.023** (0.010)	-0.022** (0.010)	-0.017* (0.010)	-0.000 (0.011)
Conflict index	0.055 (0.053)	0.062 (0.055)	0.086 (0.090)	0.077 (0.089)	0.026 (0.057)	0.054 (0.057)
Pegged regime	0.713*** (0.087)	0.691*** (0.070)	0.723*** (0.087)	0.645*** (0.111)	0.607*** (0.080)	0.545*** (0.089)
Intermediate regime	0.703*** (0.084)	0.684*** (0.072)	0.699*** (0.083)	0.636*** (0.110)	0.611*** (0.079)	0.539*** (0.090)
Southern Africa		-0.019 (0.020)		-0.034 (0.031)		-0.020 (0.022)
Central Africa		0.028 (0.021)		0.041 (0.032)		0.004 (0.022)
East Africa		0.010 (0.015)		0.021 (0.022)		-0.001 (0.020)
West Africa		-0.008 (0.015)		0.032 (0.022)		-0.051*** (0.018)
Observations	2,815	2,815	1,478	1,478	1,337	1,337
Number of surges	66	66	36	36	30	30

Notes: Cloglog estimates. The Regression coefficients are marginal effects. The dependent variable is the dummy variable equal to 1 over a 3-year window centered on the onset date of the surge. Control variables are averages over the 7 year-period prior the surge. Standard errors are adjusted for clustering at the product-year level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

The main finding is that undervaluation remains statistically significant. As with the set of simple regression analysis, the coefficient again varies by sector. It is higher for primary than for manufactured goods. The sensitivity to current undervaluation is therefore stronger for the triggering of export surges of traditional products which are less subject to international marketing uncertainties, less demanding in terms of investments and profitability horizon, more open to substitutions between crops, especially for those with an annual production cycle.

Over the sample, a one-standard-deviation of the undervaluation level increases the probability of an export acceleration by 1.31 percentage points, or a 19 percent increase in the probability of experiencing an export surge.<sup>6</sup> When we decompose the sample, the effect is respectively 1.62 for primary products, and 0.72 percentage point for manufactured goods, respectively an increase of 22 and 11 percent in the occurrence of export surges. Countries with a better human capital are more likely to experience export surges while the reverse occurs with a higher level of the relative corruption index. Broadly speaking, the results we get for these product export surges are in line with what Freund and Pierola (2012) find at a more aggregated level. A regression with jointly integrated overvaluation and undervaluation levels, i.e., with all misalignment information, yields similar results (See Appendix 3).

For a fairly large number of products, the variation in the nominal effective exchange rate translated into a product-specific undervaluation contributed to export performance. In Egypt, for example, the six export surges were concentrated in the period 2003-2006, and were preceded by a depreciation of the Egyptian pound by more than half against the currencies of the main export competitors (2000-2004). For these six products, undervaluation rates have ranged from 36% to 81% (see Appendix 1e and Appendix 1f). Similarly, the depreciation of the Kenyan shilling (1998-2002) helped cut flower exports to accelerate after 2004 (HS 0603) through a 25% undervaluation rate of the currency, just as the depreciation of the cedi (1991-2002) supported Ghana's exports of cocoa beans and processed products (HS 1801, HS 1803; HS 1804) with product-specific undervaluation rates ranging from 25% to 49%.

In some cases, the real undervaluation stemmed from a process of upgrading and increasing the sophistication level of exported products, hence resulting in the build-up of new competitive advantage. In Morocco, for instance, the export surge in the automotive sector (HS 8703) from 2012 onwards was spurred by significant foreign direct investment (Tangier-Renault project) – an efficient source of technological transfer– and enhanced by the 2014 *Industrial Acceleration Plan*. The combination of industrial policy and proactive behavior of foreign investors translated into comparative advantage on an upscale in the technological content of exports, as shown by gains in the *complexity* ranking of the *Harvard Growth lab* (Hausmann and Hidalgo, 2011), along with a product undervaluation of around 28% in the years

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<sup>6</sup> This result is obtained from column 2 of table 5 and determined as follows:  $-0.073 \times -0.18 = 1.31$ , where  $-0.18$  represents a standard deviation of undervaluation over the period 2001-2011. In order to determine what this means in the sample, the following procedure is adopted:  $1.31 / (3 \times 2.3)$ , where 1.31 is the marginal effect induced by a one standard deviation decrease in the level of undervaluation. 2.3 is the unconditional probability of observing an acceleration (see Table 2), which we multiply by 3 as onset surges are defined over a three years period ( $t-1$ ,  $t$ ,  $t+1$ ).

preceding the surge. Rather than nominal variations in the dirham exchange rate, which appreciated *vis-à-vis* the dollar and the euro in the years preceding the start of export surges, in 2007, more favorable relative costs relative to European competitors and successful industrialization policies were key.

In Gabon, such policies took the shape of a Special Economic Zones (notably in Nkok) and a drive to capture a larger share of the global value chain of wood products. Aside from the ban on exports of raw timber (which carries its share of economic distortions), such industrialization policies included a flexible application of the provisions of the labor code, availability of serviced industrial land with an access to a lower cost of electricity, and last but not least a better access to the port of Owendo. This leads us to conclude that export surges may arise in a variety of policy levers, including horizontal policies through product-specific undervaluation or vertical industrial policies.

## V. Robustness and sensitivity

The robustness checks are implemented in two ways. First, we provide alternative calculations of export surges using different definition parameters. Previous results were obtained from the scenario of Freund and Pierola (2012) with respect to the value of the parameters ( $\alpha$ ,  $\beta$ ), and the duration of surges: at least 7 years. Of course, these are ad hoc empirical hypotheses. In a second step, we ask whether an alternative estimator (i.e., ReLogit) modifies the conclusions as regard the impact of the undervaluation of currencies.

### 1. Export surges and the choice of alternative parameters

The export surge has been defined with respect to a seven-year period. Do the results change if we extend the period to 8 years or restrict it to 6 years? As shown in Figure A4.1. in Appendix 4, export surges drop by almost half with the 8-year window, and only 25 episodes out of the 59 relate to manufactured products. When a 6-year window is considered, we get 117 exports surges with 66 episodes for primary products and 51 for manufactured.

The second robustness check consists in modifying criterion 2 (Cf., section II.1). The real average growth that has been considered so far for calculating export surges  $g_{c,p,t}^1$  was 30% and at least 3 percentage points higher than that of the previous seven-year period ( $\alpha = 1.3$ ,  $\beta = 0.03$ ). What happens for alternative pairs of parameters:  $\alpha = 1.1$  and  $\beta = 0.02$ ; or  $\alpha = 1.5$  and  $\beta = 0.04$ ? Figure A4.2 in Appendix 4, depicts the number of export surges under these two modalities of measurement. Compared to the standard criterion, episodes moderately change and the proportion of surges across

categories of products is quite stable. We detect 100 episodes for the first option, respectively 56 and 44 for primary and manufactured products, against 89 episodes for the second option: 52 and 37, respectively.

Table 5 summarizes the results. To save space, only our interest variable- i.e., undervaluation, is reported. Full regressions are provided in the Appendix 4. At the onset of surges, regardless of the specification, undervaluation remains negative and statistically significant at the conventional statistical levels except in one case for manufactured goods (Horizon 6), which is only significant at 81%.

**Table 5: Robustness checks with alternative filter parameters and time horizons**

	(1)	(2)	(3)
	All	Primary	Manuf
Onset of surges			
<i>Horizon 6 (<math>\alpha = 1.3</math> and <math>\beta = 0.03</math>; 6 years)</i>			
Undervaluation	-0.106*** (-0.026)	-0.092** (-0.044)	-0.039 (-0.031)
<i>Horizon 8 (<math>\alpha = 1.3</math> and <math>\beta = 0.03</math>; 8 years)</i>			
Undervaluation	-0.057*** (-0.017)	-0.060* (-0.032)	-0.022* (-0.011)
<i>Lower criterion 2 (<math>\alpha = 1.1</math> and <math>\beta = 0.02</math>; 7 years)</i>			
Undervaluation	-0.084*** (-0.019)	-0.101*** (-0.035)	-0.048** (-0.021)
<i>Higher criterion 2 (<math>\alpha = 1.5</math> and <math>\beta = 0.04</math>; 7 years)</i>			
Undervaluation	-0.065*** (-0.017)	-0.075** (-0.031)	-0.037** (-0.016)

Notes: cloglog estimates. The coefficients reported are marginal effect evaluated at the sample means. The dependent variable is the dummy variable equal to 1 over a 3-year window centered on the onset date. All controls are averages over 7 years prior to the surge initiation. The Table only displays the coefficient of the variable of interest. Refer to Appendix 4 for all results. Standard errors are adjusted for clustering at the product-year level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## 2. Alternative estimation technique

As an alternative estimation method, we use the rare event logit (ReLogit) proposed by King and Zeng (2001). Unlike the cloglog, which follows an asymmetric distribution, the ReLogit follows a symmetric distribution since it is based on a modified logit specifically designed to better handle and mitigate the biases associated with rare events.

Regression results are presented in Table 6 for the period of the surge over the initial time horizon (7 years) and filter parameters ( $\alpha = 1.3$  and  $\beta = 0.03$ ). With this standard scenario, in all empirical cases the coefficient of the undervaluation variable remains strongly statistically significant.

**Table 6: Onset of export surges - ReLogit estimates (2001-2012)**

	(1) All	(2) All	(3) Primary	(4) Primary	(5) Manuf	(6) Manuf
Log (Per cap GDP)	-0.767*** (0.212)	-0.618*** (0.197)	-0.821 (1.243)	-0.309 (0.977)	-0.430*** (0.162)	-0.089 (0.237)
Log (Per cap GDP) <sup>2</sup>	0.008 (0.019)	-0.008 (0.019)	0.019 (0.083)	-0.008 (0.063)	-0.019 (0.017)	-0.060** (0.026)
Log (Secondary education)	0.483*** (0.105)	0.532*** (0.129)	0.573*** (0.140)	0.589*** (0.183)	0.368** (0.152)	0.415** (0.171)
Undervaluation	-1.642*** (0.412)	-1.710*** (0.406)	-1.396** (0.712)	-1.713** (0.679)	-1.782*** (0.499)	-1.511*** (0.554)
Market share	-0.017 (0.011)	-0.016 (0.012)	-0.017 (0.012)	-0.013 (0.011)	-0.011 (0.041)	-0.016 (0.051)
Relative Internet users	0.017** (0.007)	0.018** (0.007)	0.015 (0.010)	0.016 (0.010)	0.019** (0.009)	0.023** (0.010)
Relative Corruption index	-0.433*** (0.159)	-0.428*** (0.161)	-0.451** (0.213)	-0.439** (0.192)	-0.385* (0.219)	-0.160 (0.260)
Conflict index	1.120 (1.081)	1.165 (1.114)	1.955 (1.626)	1.805 (1.610)	0.249 (1.398)	0.651 (1.519)
Pegged regime	1.366* (0.700)	0.947 (0.609)	1.090 (4.533)	-1.910 (3.805)	0.633 (0.558)	0.889 (0.562)
Intermediate regime	1.081 (0.696)	0.754 (0.553)	0.657 (4.522)	-2.054 (3.757)	0.505 (0.492)	0.533 (0.453)
Southern Africa		-0.412 (0.409)		-0.475 (0.634)		-0.399 (0.557)
Central Africa		0.548 (0.428)		0.912 (0.624)		0.068 (0.600)
East Africa		0.012 (0.297)		0.515 (0.411)		-0.543 (0.496)
West Africa		-0.193 (0.305)		0.688* (0.411)		-1.354*** (0.499)
Observations	2,815	2,815	1,478	1,478	1,337	1,337
Number of surges	66	66	36	36	30	30

Notes: ReLogit estimates. The coefficients reported are not marginal effect. The dependent variable is the dummy variable equal to 1 over a 3-year window centered on the onset date. All control variables are averages over 7 years prior to the surge initiation. Standard errors are adjusted for clustering at the product-year level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## VI. Conclusion

The role of product-specific currency undervaluation is explored to shed light on the performance of Africa's disaggregated exports. The surge episode identification methodology is applied to primary and manufactured products. Over the period 1995-2017, we identified 96 export surge episodes for a total of 149 primary and manufactured export products (4-digit HS code) of 41 African countries. The majority of episodes occurred in middle-income African countries. Country-product pairs of real exchange rate misalignments are calculated on an annual basis. For this variable of interest, the use of the cloglog estimator allows the identification of the impact while controlling for other determinants. On average, exchange rate undervaluation preceded export surges. A one standard deviation increase in the level of the country's product undervaluation increases the probability of a surge by 1.3 percentage points. When the sample is split into primary and manufactured goods, the effect is 1.6 and 0.7 percentage points, or a 22% and 11% increase in the occurrence of surges in the sample, respectively. These results are robust to changes in the filter parameters of the surges, to the time frame of their duration, and to the use of the ReLogit as an alternative to the cloglog estimator.

What does this empirical analysis tell us? Identifying a product-specific exchange rate misalignment - i.e., the difference in unit production costs relative to competitors - provides information about the ability of firms to export the product on a sustainable basis with a normal profit margin. While variations in the official exchange rate can play a role in achieving this competitiveness objective, it is unlikely that the nominal exchange rate, which is by definition unique, can meet a country's expectations for all the products that make up its core international specialization. Product-specific misalignments are therefore important to signal potential changes needed not only in exchange rate policy, but also in the production behavior of exporting firms and in the accompanying measures of public policies. A large number of works today call for a rebirth of industrial policies, in the broadest sense- i.e., including production activities based on the transformation of primary products and the appropriate promotion of tradable services. Such strategies call for country-specific combinations of horizontal and vertical public measures, with nominal exchange rate adjustments being just one policy dimension interacting with other economic policy instruments. As recently emphasized by Aiginger and Rodrik (2020), industrial policy must not conflict with other dimensions of public interventions, such as the competition or trade policy, as well as regional or tax policies. A successful industrial policy should include sectoral elements, identify the goods and sectors that are important to a country, and support horizontal activities that shape the business environment. One of the key challenges of structural transformation is therefore to design horizontal and vertical policies that are complementary rather than substitutes and that promote sectoral or firm-level cherry picking in a non-clientelist manner. Such policies could be crucial for fostering sustained economic growth in small yet open low-income and sub-Saharan economies.

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## Appendices:

### Appendix 1: Sample and data

#### Appendix 1a: List of countries

Algeria, Angola, Benin, Burundi, Burkina Faso, Cabo Verde, Central African Rep, Cameroon, Chad, Cote D'Ivoire, Comoros, Congo Dem. Rep., Congo Rep. of, Egypt, Ethiopia, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Niger, Nigeria, Rwanda, Senegal, Tanzania, Sierra Leone, South Africa, Togo, Tunisia, Uganda, Zambia.

#### Appendix 1b: Correlation table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Export Surges (=1, dummy)	1.000												
(2) Market share (in %)	-0.008	1.000											
(3) Undervaluation (in %)	-0.048	-0.012	1.000										
(4) Overvaluation (in %)	-0.008	-0.110	0.413	1.000									
(5) Log(per cap GDP)	-0.031	0.078	-0.320	-0.311	1.000								
(6) Log(per cap GDP) <sup>2</sup>	-0.036	0.071	-0.306	-0.288	0.997	1.000							
(7) Log(Secondary education)	0.024	0.119	-0.228	-0.214	0.537	0.520	1.000						
(8) Relative internet users	0.019	0.157	-0.052	-0.018	0.141	0.136	0.062	1.000					
(9) Relative Corruption index	-0.025	-0.156	0.168	0.300	-0.155	-0.137	-0.147	-0.357	1.000				
(10) Conflict index	-0.007	0.037	-0.040	-0.023	0.063	0.057	0.080	0.031	-0.058	1.000			
(11) Pegged regime	-0.026	-0.040	0.238	0.212	0.080	0.079	-0.091	-0.078	0.362	-0.090	1.000		
(12) Intermediate regime	0.043	0.052	-0.218	-0.209	-0.071	-0.070	0.112	0.079	-0.389	0.052	-0.934	1.000	
(13) Floating regime	-0.049	-0.037	-0.048	-0.002	-0.026	-0.028	-0.083	-0.004	0.087	0.127	-0.153	-0.209	1.000

**Table A1: Selected products and regional contribution to primary and manufactured exports**  
(In percentages, excluding crude oil, gas and minerals)

	Mean	Standard deviation	Lower Share	Higher share
<b>Central Africa</b>				
Primary	92	8	80(CMR)	100 (CAF, GNQ, TCD)
Manufactured	59	38	5 (COG)	97 (TCD)
<b>East Africa</b>				
Primary	75	16	52 (TZA)	100 (COM)
Manufactured	48	15	24 (KEN)	81 (MWI)
<b>Northern Africa</b>				
Primary	53	18	32 (EGY)	81 (DZA)
Manufactured	43	17	23 (EGY)	65 (DZA)
<b>Southern Africa</b>				
Primary	69	26	36 (ZAF)	97 (AGO)
Manufactured	31	15	11 (AGO)	43 (ZAF)
<b>West Africa</b>				
Primary	84	14	51 (SEN)	100 (CPV, GNB)
Manufactured	56	29	0,4 (LBR)	100 (MRT)
<b>Africa (total)</b>				
Primary	78	19	32	100
Manufactured	51	27	0	100

Source: Authors using BACI 2019. Countries are identified in the table by their ISO Alpha-3 code. Mean is the weighted average of the top 5 exported products over the period 2009-2013, excluding natural rent products and potential chapters for which we presume reexports or second-hand exports. The last two columns provide respectively regional lower and higher shares with the ISO three letter code of countries in parentheses.

## Appendix 1c: List of primary products

1	<b>HS-0303</b>	Fish, frozen, excluding fish fillets	34	<b>HS-0701</b>	Potatoes, fresh or chilled.
2	<b>HS-0306</b>	Crustaceans, whether in shell or not	35	<b>HS-0805</b>	Citrus fruit, fresh or dried.
3	<b>HS-0901</b>	Coffee, whether or not roasted or decaff	36	<b>HS-0603</b>	Cut flowers and flower buds of a kind
4	<b>HS-2301</b>	Flours, meals and pellets, of meat or me	37	<b>HS-0713</b>	Dried leguminous vegetables, shelled
5	<b>HS-4403</b>	Wood in the rough, whether or not stripp	38	<b>HS-2403</b>	Other manufactured tobacco and manufactu
6	<b>HS-0902</b>	Tea, whether or not flavoured.	39	<b>HS-4406</b>	Railway or tramway sleepers (cross-ties)
7	<b>HS-2203</b>	Beer made from malt.	40	<b>HS-1202</b>	Ground-nuts, not roasted or otherwise
8	<b>HS-2402</b>	Cigars, cheroots, cigarillos and cigaret	41	<b>HS-1508</b>	Ground-nut oil and its fractions
9	<b>HS-5201</b>	Cotton, not carded or combed.	42	<b>HS-0708</b>	Leguminous vegetables, shelled or unshelled
10	<b>HS-0207</b>	Meat and edible offal, of the poultry of	43	<b>HS-4002</b>	Synthetic rubber and factice derived fro
11	<b>HS-0801</b>	Coconuts, Brazil nuts and cashew nuts	44	<b>HS-0307</b>	Molluscs, whether in shell or not, live,
12	<b>HS-1006</b>	Rice.	45	<b>HS-0702</b>	Tomatoes, fresh or chilled.
13	<b>HS-0804</b>	Dates, figs, pineapples, avocados, guava	46	<b>HS-0810</b>	Other fruit, fresh.
14	<b>HS-1207</b>	Other oil seeds and oleaginous fruits	47	<b>HS-0102</b>	Live bovine animals.
15	<b>HS-1515</b>	Other fixed vegetable fats and oils	48	<b>HS-5203</b>	Cotton, carded or combed.
16	<b>HS-1701</b>	Cane or beet sugar and chemically pure	49	<b>HS-0302</b>	Fish, fresh or chilled, excluding fish f
17	<b>HS-4407</b>	Wood sawn or chipped lengthwise, sliced	50	<b>HS-1504</b>	Fats and oils and their fractions, of fi
18	<b>HS-1801</b>	Cocoa beans, whole or broken, raw	51	<b>HS-0106</b>	Other live animals.
19	<b>HS-1803</b>	Cocoa paste, whether or not defatted.	52	<b>HS-1703</b>	Molasses resulting from the extraction o
20	<b>HS-1804</b>	Cocoa butter, fat and oil.	53	<b>HS-0104</b>	Live sheep and goats.
21	<b>HS-4001</b>	Natural rubber, balata, gutta-percha	54	<b>HS-6309</b>	Worn clothing and other worn articles.
22	<b>HS-0803</b>	Bananas, including plantains, fresh or d	55	<b>HS-0401</b>	Milk and cream, not concentrated nor con
23	<b>HS-1211</b>	Plants and parts of plants	56	<b>HS-1101</b>	Wheat or meslin flour.
24	<b>HS-2401</b>	Unmanufactured tobacco; tobacco refuse.	57	<b>HS-2104</b>	Soups and broths and preparations
25	<b>HS-4401</b>	Fuel wood, in logs, in billets, in twigs	58	<b>HS-1301</b>	Lac; natural gums, resins, gum-resins an
26	<b>HS-0905</b>	Vanilla.	59	<b>HS-1509</b>	Olive oil and its fractions, whether or
27	<b>HS-0907</b>	Cloves (whole fruit, cloves and stems).	60	<b>HS-0304</b>	Fish fillets and other fish meat
28	<b>HS-4402</b>	Wood charcoal (including shell or nut	61	<b>HS-0806</b>	Grapes, fresh or dried.
29	<b>HS-1604</b>	Prepared or preserved fish; caviar	62	<b>HS-0808</b>	Apples, pears and quinces, fresh.
30	<b>HS-0709</b>	Other vegetables, fresh or chilled.	63	<b>HS-2204</b>	Wine of fresh grapes
31	<b>HS-1001</b>	Wheat and meslin.	64	<b>HS-4702</b>	Chemical wood pulp, dissolving grades.
32	<b>HS-2202</b>	Waters, including mineral waters	65	<b>HS-1005</b>	Maize (corn).
33	<b>HS-0406</b>	Cheese and curd.	66	<b>HS-2208</b>	Undenatured ethyl alcohol of an alcoholi

## Appendix 1d: List of manufactured products

1	HS-2523	Portland cement, aluminous cement, slag	43	HS-6205	Men's or boys' shirts.
2	HS-2804	Hydrogen, rare gases and other non-metal	44	HS-6206	Women's or girls' blouses, shirts
3	HS-2807	Sulphuric acid; oleum.	45	HS-6210	Garments, made up of fabrics of heading
4	HS-2809	Diphosphorus pentaoxide; phosphoric acid	46	HS-6304	Other furnishing articles
5	HS-2814	Ammonia, anhydrous or in aqueous solutio	47	HS-6305	Sacks and bags
6	HS-2822	Cobalt oxides and hydroxides; commercial	48	HS-6402	Other footwear with outer soles
7	HS-2836	Carbonates; peroxocarbonates	49	HS-6403	Footwear with outer soles of rubber
8	HS-2844	Radioactive chemical elements	50	HS-6405	Other footwear.
9	HS-2901	Acyclic hydrocarbons.	51	HS-6406	Parts of footwear (including uppers)
10	HS-2905	Acyclic alcohols and their halogenated,	52	HS-6704	Wigs, false beards, eyebrows and eyelash
11	HS-3004	Medicaments (excluding goods of heading	53	HS-6810	Articles of cement, of concrete
12	HS-3102	Mineral or chemical fertilisers,	54	HS-7005	Float glass and surface ground or polish
13	HS-3105	Mineral or chemical fertilisers	55	HS-7010	Carboys, bottles, flasks, jars, pots
14	HS-3301	Essential oils (terpeneless or not)	56	HS-7102	Diamonds, whether or not worked, but not
15	HS-3304	Beauty or make-up preparations	57	HS-7103	Precious stones (other than diamonds) an
16	HS-3401	Soap; organic surface-active products	58	HS-7113	Articles of jewellery and parts thereof,
17	HS-3507	Enzymes; prepared enzymes not elsewhere	59	HS-7202	Ferro-alloys.
18	HS-3802	Activated carbon; activated natural mine	60	HS-7208	Flat-rolled products of iron or non-allo
19	HS-3811	Anti-knock preparations, oxidation	61	HS-7210	Flat-rolled products of iron or non-allo
20	HS-3823	Industrial monocarboxylic fatty acids	62	HS-7213	Bars and rods, hot-rolled
21	HS-3902	Polymers of propylene or of other	63	HS-7214	Other bars and rods of iron or non-alloy
22	HS-3923	Articles for the conveyance or packing	64	HS-7215	Other bars and rods of iron or non-alloy
23	HS-3924	Tableware, kitchenware, other household	65	HS-7225	Flat-rolled products of other alloy
24	HS-4105	Tanned or crust skins of sheep or lambs,	66	HS-7304	Tubes, pipes and hollow profiles,
25	HS-4106	Tanned or crust hides and skins of other	67	HS-7306	Other tubes, pipes and hollow profiles
26	HS-4107	Leather further prepared after tanning	68	HS-7308	Structures (excluding prefabricated buil
27	HS-4408	Sheets for veneering	69	HS-7326	Other articles of iron or steel.
28	HS-4412	Plywood, veneered panels	70	HS-8207	Interchangeable tools for hand tools
29	HS-4802	Uncoated paper and paperboard	71	HS-8502	Electric generating sets and rotary
30	HS-4804	Uncoated kraft paper and paperboard	72	HS-8504	Electrical transformers
31	HS-4819	Cartons, boxes, cases, bags	73	HS-8517	Telephone sets, including telephones for
32	HS-4907	Unused postage, revenue or similar stamp	74	HS-8525	Transmission apparatus for radio
33	HS-5205	Cotton yarn (other than sewing thread)	75	HS-8536	Electrical apparatus for switching
34	HS-5208	Woven fabrics of cotton, containing 85 %	76	HS-8537	Boards, panels, consoles, desks, cabinet
35	HS-5408	Woven fabrics of artificial filament yar	77	HS-8544	Insulated (including enamelled
36	HS-5701	Carpets and other textile floor covering	78	HS-8703	Motor cars and other motor vehicles
37	HS-6104	Women's or girls' suits, ensembles, jack	79	HS-8704	Motor vehicles for the transport of good
38	HS-6107	Men's or boys' underpants, briefs, night	80	HS-8708	Parts and accessories of the motor
39	HS-6109	T-shirts, singlets and other vests, knit	81	HS-9015	Surveying
40	HS-6110	Jerseys, pullovers, cardigans, waistcoat	82	HS-9401	Seats (other than those of heading 94.02
41	HS-6203	Men's or boys' suits, ensembles, jackets	83	HS-9406	Prefabricated buildings.
42	HS-6204	Women's or girls' suits, ensembles, jack			

## Appendix 1e: Primary products – pre-surge misalignment and year of surge

Country	Product (HS-4)	Year	Weight*	Pre-surge misalignment
Algeria	HS-0804 Dates, figs, pineapples, avocados,	2011	7.0%	-37.5%
Benin	HS-0801 Coconuts, Brazil nuts and cashew nuts	2008	27.0%	46.1%
Burkina Faso	HS-1515 Other fixed vegetable fats and oils	2011	1.3%	19.8%
Burkina Faso	HS-5201 Cotton, not carded or combed.	2003	74.5%	10.3%
Burkina Faso	HS-0801 Coconuts, Brazil nuts and cashew nuts	2011	4.7%	45.3%
Burkina Faso	HS-0804 Dates, figs, pineapples, avocados,	2003	1.5%	9.0%
Cabo Verde	HS-1604 Prepared or preserved fish; caviar	2009	46.7%	34.2%
Cameroon	HS-1801 Cocoa beans, whole or broken, raw	2004	26.0%	37.3%
Congo Dem. Rep. of	HS-1211 Plants and parts of plants	2006	4.3%	58.4%
Congo Dem. Rep. of	HS-4403 Wood in the rough, whether or not	2004	40.7%	46.5%
Congo Dem. Rep. of	HS-4407 Wood sawn or chipped lengthwise	2006	23.8%	45.1%
Congo Rep. of	HS-4001 Natural rubber, balata, gutta-perch	2005	4.7%	19.8%
Congo Rep. of	HS-4403 Wood in the rough, whether or not	2007	65.6%	-13.8%
Cote D' Ivoire	HS-4001 Natural rubber, balata, gutta-perch	2010	11.7%	59.6%
Cote D' Ivoire	HS-0801 Coconuts, Brazil nuts and cashew nuts	2004	4.5%	29.3%
Egypt	HS-0406 Cheese and curd.	2003	7.5%	-73.5%
Egypt	HS-0701 Potatoes, fresh or chilled.	2005	4.7%	-80.7%
Egypt	HS-0805 Citrus fruit, fresh or dried.	2003	11.4%	-52.9%
Ethiopia	HS-0603 Cut flowers and flower buds	2003	9.8%	16.0%
Ethiopia	HS-0709 Other vegetables, fresh or chilled.	2006	12.7%	-4.3%
Ethiopia	HS-0713 Dried leguminous vegetables	2010	7.3%	5.8%
Gabon	HS-4001 Natural rubber, balata, gutta-perch	2005	11.0%	50.5%
Gabon	HS-4407 Wood sawn or chipped lengthwise	2011	30.9%	26.5%
Ghana	HS-1801 Cocoa beans, whole or broken	2004	52.8%	-28.1%
Ghana	HS-1803 Cocoa paste, whether or not defatte	2004	9.0%	-48.7%
Ghana	HS-1804 Cocoa butter, fat and oil.	2009	4.5%	-24.8%
Ghana	HS-0801 Coconuts, Brazil nuts and cashew nuts	2011	4.2%	16.4%
Guinea Bissau	HS-0303 Fish, frozen, excluding fish fillet	2010	11.1%	14.7%
Guinea Bissau	HS-0801 Coconuts, Brazil nuts and cashew nuts	2011	84.4%	46.2%
Kenya	HS-0603 Cut flowers and flower buds	2004	18.5%	-25.4%
Liberia	HS-1801 Cocoa beans, whole or broken	2008	6.7%	37.1%
Malawi	HS-2401 Unmanufactured tobacco; tobacco	2005	65.8%	24.2%
Malawi	HS-5201 Cotton, not carded or combed.	2004	3.6%	13.2%
Malawi	HS-0713 Dried leguminous vegetables	2007	5.3%	19.1%
Mali	HS-1207 Other oil seeds and oleaginous	2006	6.5%	-0.5%
Mali	HS-0804 Dates, figs, pineapples, avocados,	2003	3.3%	-14.9%
Mauritania	HS-1504 Fats and oils and their fractions,	2009	1.2%	-35.4%
Mauritania	HS-2301 Flours, meals and pellets, of meat	2010	6.0%	-22.2%
Morocco	HS-0702 Tomatoes, fresh or chilled.	2007	11.2%	-15.8%
Mozambique	HS-4407 Wood sawn or chipped lengthwise	2007	6.9%	68.1%
Niger	HS-1701 Cane or beet sugar and chemically	2010	3.2%	48.7%
Niger	HS-6309 Worn clothing and other worn article	2005	7.4%	-6.6%
Nigeria	HS-1207 Other oil seeds and oleaginous	2005	6.3%	-33.0%
Nigeria	HS-1801 Cocoa beans, whole or broken	2003	31.0%	-18.7%
Nigeria	HS-4001 Natural rubber, balata, gutta-perch	2006	19.4%	23.4%
Nigeria	HS-0801 Coconuts, Brazil nuts and cashew nuts	2003	4.9%	-9.5%
Senegal	HS-0303 Fish, frozen, excluding fish fillet	2007	17.7%	3.5%
Sierra Leone	HS-1801 Cocoa beans, whole or broken	2004	67.0%	37.2%
South Africa	HS-4702 Chemical wood pulp, dissolving grad	2010	5.7%	-21.3%
Tanzania	HS-2401 Unmanufactured tobacco; tobacco ref	2005	15.9%	20.6%
Tanzania	HS-0801 Coconuts, Brazil nuts and cashew nu	2009	8.8%	24.5%
The Gambia	HS-0303 Fish, frozen, excluding fish fillet	2008	4.6%	10.6%
Togo	HS-1801 Cocoa beans, whole or broken, raw o	2004	45.1%	48.8%
Tunisia	HS-0804 Dates, figs, pineapples, avocados,	2004	13.3%	-6.4%
Uganda	HS-1701 Cane or beet sugar and chemically	2005	4.6%	33.5%

\* The weight corresponds to the product's share of total exports in its category. Pre-surge misalignment is the average misalignment over the 7-year period prior to the surge.

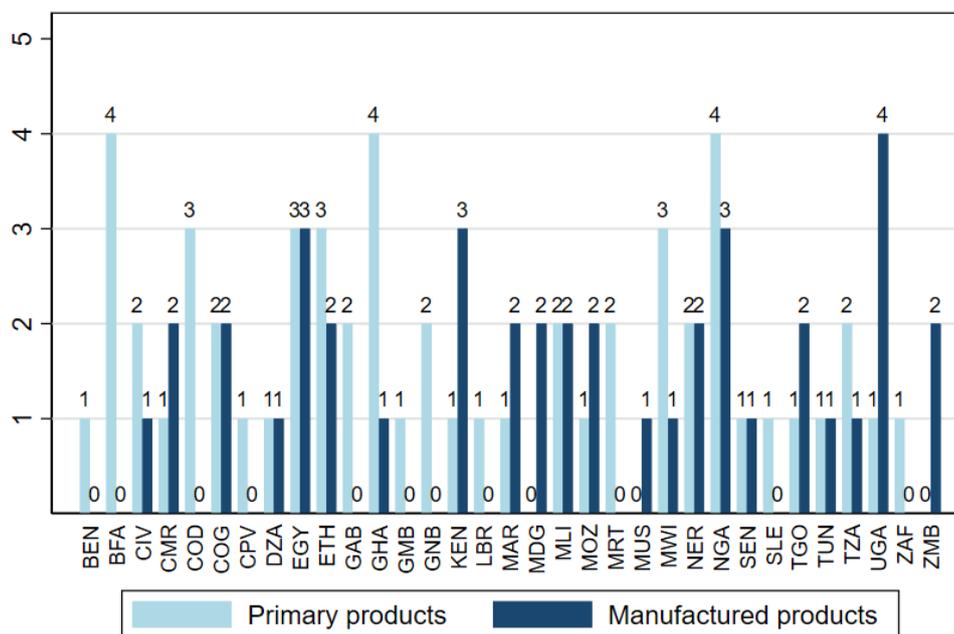
## Appendix 1f: Manufactured products – pre-surge misalignment and year of surge

Country	Product (HS-4)	Year	Weight*	Pre-surge misalignment
Cote D' Ivoire	HS-3923 Articles for the conveyance or pack	2009	4.1%	-2.6%
Cameroon	HS-3401 Soap; organic surface-active produc	2005	8.2%	16.0%
Cameroon	HS-4819 Cartons, boxes, cases, bags	2005	3.9%	-6.4%
Congo Rep. of	HS-4408 Sheets for veneering	2007	1.2%	-16.2%
Congo Rep. of	HS-7326 Other articles of iron or steel.	2005	1.1%	-50.4%
Algeria	HS-8703 Motor cars and other motor vehicles	2005	11.8%	-93.8%
Egypt	HS-3102 Mineral or chemical fertilisers	2006	8.5%	-36.2%
Egypt	HS-6203 Men's or boys' suits, ensembles	2003	3.5%	-42.9%
Egypt	HS-6204 Women's or girls' suits, ensembles,	2004	2.6%	-44.0%
Ethiopia	HS-6109 T-shirts, singlets and other vests	2010	3.7%	24.7%
Ethiopia	HS-6403 Footwear with outer soles of rubber	2005	3.2%	24.1%
Ghana	HS-3304 Beauty or make-up preparations and	2011	4.8%	-30.8%
Kenya	HS-2523 Portland cement, aluminous cement,	2005	5.0%	-7.8%
Kenya	HS-2836 Carbonates; peroxocarbonates	2003	7.1%	-29.9%
Kenya	HS-3923 Articles for the conveyance or pack	2006	3.6%	-35.9%
Morocco	HS-3105 Mineral or chemical fertilisers	2010	10.8%	2.0%
Morocco	HS-8703 Motor cars and other motor vehicles	2007	4.5%	-28.1%
Madagascar	HS-3301 Essential oils (terpeneless or not)	2007	4.8%	-9.3%
Madagascar	HS-6205 Men's or boys' shirts.	2007	5.4%	1.5%
Mali	HS-4105 Tanned or crust skins of sheep	2010	7.1%	6.4%
Mali	HS-8517 Telephone sets, including telephone	2003	2.2%	-16.1%
Mozambique	HS-7103 Precious stones (other than diamond	2011	6.1%	65.8%
Mozambique	HS-7306 Other tubes, pipes and hollow	2010	6.8%	53.5%
Mauritius	HS-6104 Women's or girls' suits, ensembles	2009	4.3%	4.5%
Malawi	HS-4412 Plywood, veneered panels	2004	2.7%	40.8%
Niger	HS-2844 Radioactive chemical elements	2009	92.0%	22.3%
Niger	HS-8517 Telephone sets, including telephone	2009	0.5%	34.4%
Nigeria	HS-4105 Tanned or crust skins of sheep	2004	4.8%	-28.3%
Nigeria	HS-4106 Tanned or crust hides and skins	2003	14.9%	-24.7%
Nigeria	HS-6402 Other footwear with outer soles	2006	4.4%	-13.7%
Senegal	HS-7213 Bars and rods, hot-rolled	2007	3.3%	0.9%
Togo	HS-3923 Articles for the conveyance or pack	2003	5.5%	3.8%
Togo	HS-6704 Wigs, false beards, eyebrows	2009	2.5%	54.5%
Tunisia	HS-6403 Footwear with outer soles of rubber	2003	3.5%	6.8%
Tanzania	HS-3105 Mineral or chemical fertilisers	2005	6.1%	14.8%
Uganda	HS-2523 Portland cement, aluminous cement,	2004	17.6%	31.9%
Uganda	HS-3401 Soap; organic surface-active produc	2003	4.7%	31.7%
Uganda	HS-7210 Flat-rolled products of iron or non	2003	4.4%	4.6%
Uganda	HS-8525 Transmission apparatus for radio	2005	17.0%	15.4%
Zambia	HS-2523 Portland cement, aluminous cement,	2008	12.1%	-1.5%
Zambia	HS-2807 Sulphuric acid; oleum.	2007	10.9%	-44.2%

\* The weight corresponds to the product's share of total exports in its category. Pre-surge misalignment is the average misalignment over the 7-year period prior to the surge.

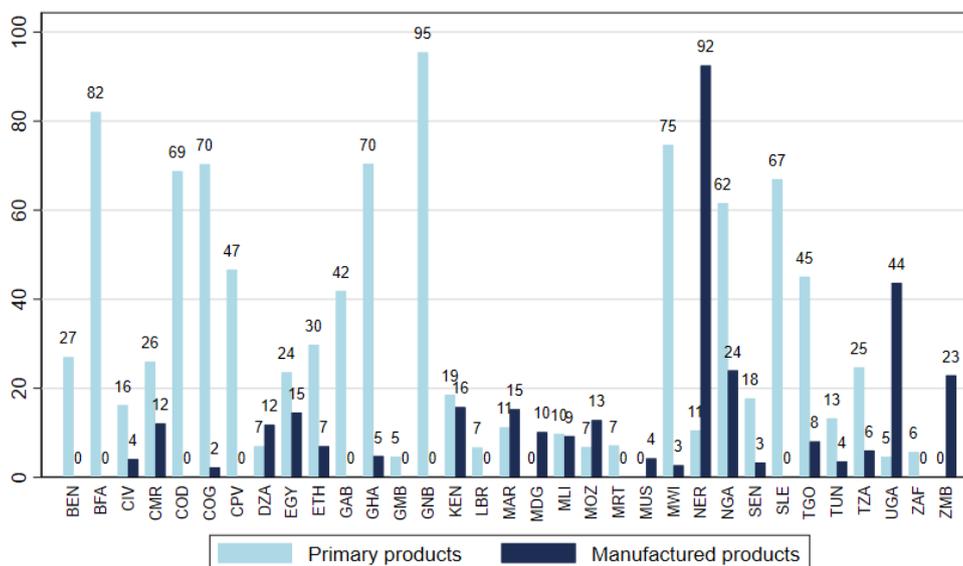
## Appendix 2: Surge episodes and their contribution to product categories

Appendix 2a: Number of export surges, by country among top 5 products of each category



Source: BACI 2019

Appendix 2b: Percentage of product surges among all products considered for each category (%)



Source: BACI 2019

## Appendix 3: Regressions with the overvaluation level as an additional control (Cloglog)

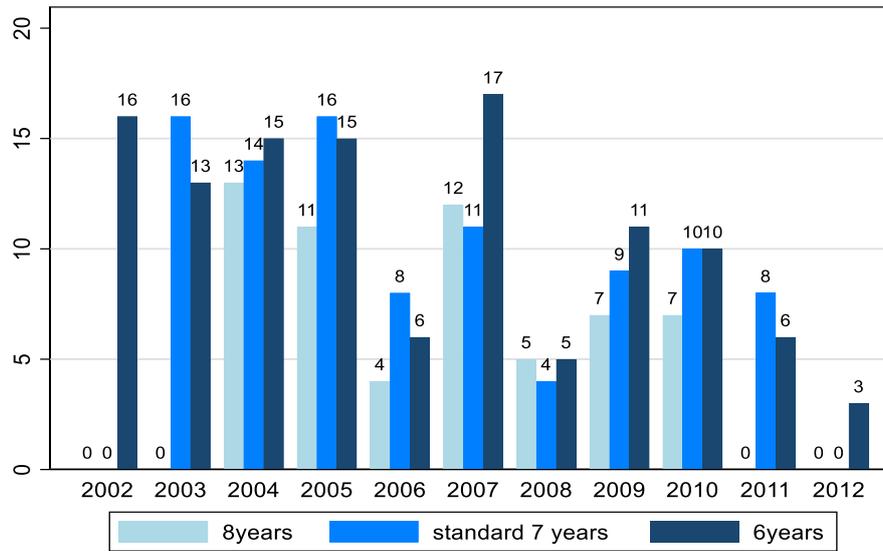
Baseline regression results. Onset of export surges: cloglog results (2001-2012)

	(1) All	(2) All	(3) Primary	(4) Primary	(5) Manu	(6) Manu
Log(GDP per cap)	0.024 (0.067)	0.076 (0.069)	-0.082 (0.099)	-0.065 (0.098)	0.143* (0.086)	0.253*** (0.084)
Log(GDP per cap) <sup>2</sup>	-0.004 (0.005)	-0.008* (0.005)	0.004 (0.007)	0.003 (0.006)	-0.012** (0.006)	-0.020*** (0.006)
Log(Secondary education)	0.022*** (0.005)	0.024*** (0.006)	0.031*** (0.007)	0.030*** (0.009)	0.015** (0.007)	0.012* (0.007)
Undervaluation	-0.069*** (0.020)	-0.071*** (0.019)	-0.078** (0.039)	-0.088** (0.035)	-0.050** (0.024)	-0.038* (0.020)
<b>Overvaluation</b>	<b>-0.012 (0.028)</b>	<b>-0.014 (0.027)</b>	<b>0.000 (0.034)</b>	<b>-0.005 (0.032)</b>	<b>-0.034 (0.049)</b>	<b>-0.019 (0.041)</b>
Market share	-0.001* (0.001)	-0.001* (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.002 (0.002)	-0.002 (0.002)
Relative Internet users	0.001*** (0.000)	0.001*** (0.000)	0.001 (0.001)	0.001* (0.001)	0.001** (0.000)	0.001** (0.000)
Relative Corruption index	-0.020*** (0.007)	-0.018** (0.008)	-0.023** (0.010)	-0.022** (0.009)	-0.017 (0.010)	-0.000 (0.012)
Conflict index	0.055 (0.052)	0.063 (0.055)	0.086 (0.091)	0.077 (0.089)	0.020 (0.058)	0.051 (0.058)
Pegged regime	0.712*** (0.044)	0.637*** (0.068)	0.723*** (0.102)	0.645*** (0.086)	0.604*** (0.117)	0.545*** (0.071)
Intermediate regime	0.701*** (0.047)	0.630*** (0.069)	0.698*** (0.101)	0.636*** (0.083)	0.605*** (0.119)	0.538*** (0.070)
Southern Africa		-0.019 (0.020)		-0.034 (0.031)		-0.020 (0.022)
Central Africa		0.029 (0.021)		0.041 (0.032)		0.004 (0.022)
East Africa		0.009 (0.015)		0.021 (0.022)		-0.002 (0.020)
West Africa		-0.008 (0.015)		0.032 (0.022)		-0.051*** (0.017)
Observations	2,815	2,815	1,478	1,478	1,337	1,337
Number of surges	66	66	36	36	30	30

Notes: Cloglog estimates. The regression coefficients are marginal effects. The dependent variable is the dummy variable equal to 1 over a 3-year window centered on the onset date of the surge. Control variables are averages over the 7 year-period prior the surge. Standard errors are adjusted for clustering at the product-year level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

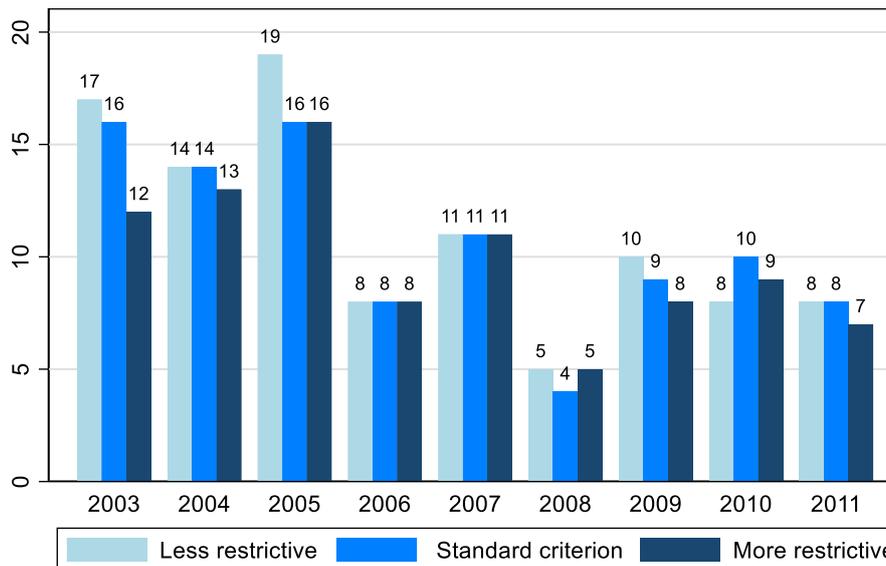
## Appendix 4: Robustness - alternative parameters (Cloglog)

Figure A.4.1: Sensitivity of export surges to the time window



Source: BACI 2019

Figure A.4.2: Modification of criterion 2 and export surges over the period



Source: BACI 2019

**Appendix 4a: Robustness about the onset surges: Horizon 6 and 8**

	(1) All	(2) Primary	(3) Manu	(4) All	(5) Primary	(5) Manu
	<b>Horizon 6</b>			<b>Horizon 8</b>		
	<b>(<math>\alpha = 1.3</math> and <math>\beta = 0.03</math>; 6 years)</b>			<b>(<math>\alpha = 1.3</math> and <math>\beta = 0.03</math>; 8 years)</b>		
Log (Per cap GDP)	0.069 (0.084)	0.067 (0.115)	0.114 (0.102)	0.023 (0.071)	-0.082 (0.113)	0.105** (0.043)
Log (Per cap GDP) <sup>2</sup>	-0.008 (0.006)	-0.006 (0.007)	-0.012* (0.007)	-0.004 (0.005)	0.005 (0.007)	-0.009*** (0.003)
Log (Secondary education)	0.034*** (0.009)	0.019* (0.011)	0.042*** (0.010)	0.016*** (0.006)	0.018** (0.008)	0.007 (0.004)
Undervaluation	-0.106*** (0.026)	-0.092** (0.044)	-0.039 (0.031)	-0.057*** (0.017)	-0.060* (0.032)	-0.022* (0.011)
Market share	-0.003*** (0.001)	-0.002** (0.001)	-0.009 (0.008)	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)
Relative Internet users	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Relative Corruption index	-0.030** (0.013)	-0.022 (0.015)	-0.013 (0.014)	-0.012* (0.007)	-0.005 (0.007)	-0.007 (0.006)
Conflict index	0.090 (0.082)	0.140 (0.102)	0.028 (0.090)	0.046 (0.048)	-0.006 (0.079)	0.063** (0.028)
Pegged regime	0.097 (0.080)	0.890*** (0.122)	0.072 (0.059)	0.006 (0.043)	-0.059 (0.050)	0.188*** (0.054)
Intermediate regime	0.071 (0.080)	0.880*** (0.125)	0.027 (0.057)	0.027 (0.043)	-0.044 (0.049)	0.205*** (0.053)
Southern Africa	-0.033 (0.027)	-0.068 (0.042)	0.000 (0.027)	-0.004 (0.017)	-0.028 (0.031)	-0.005 (0.010)
Central Africa	0.027 (0.027)	0.041 (0.036)	-0.017 (0.029)	0.032* (0.019)	0.012 (0.030)	0.020 (0.014)
East Africa	0.023 (0.022)	0.034 (0.026)	-0.002 (0.028)	-0.007 (0.014)	0.006 (0.022)	-0.016* (0.009)
West Africa	-0.014 (0.021)	0.058** (0.026)	-0.104*** (0.022)	-0.007 (0.014)	0.032 (0.021)	-0.029*** (0.011)
Observations	2,686	1,403	1,283	2,647	1,397	1,250
Number of surges	84	46	38	41	23	18

Notes: cloglog estimates. The coefficients reported are marginal effect evaluated at the sample means. The dependent variable is a dummy that is equal to 1 over a 3-year window centered on the onset date of the surge. Controls are averages over the 7 year-period prior the surge. Standard errors are adjusted for clustering at the product-year level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

**Appendix 4b: Robustness about the onset surges: Lower criterion 2 and Higher criterion 2**

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Primary	Manu	All	Primary	Manu
	<b>Lower criterion</b>			<b>Higher criterion</b>		
	<b>(<math>\alpha = 1.1</math> and <math>\beta = 0.02</math>; 7 years)</b>			<b>(<math>\alpha = 1.5</math> and <math>\beta = 0.04</math>; 7 years)</b>		
Log(Per cap GDP )	0.078 (0.074)	-0.108 (0.112)	0.294*** (0.084)	0.078 (0.062)	-0.075 (0.085)	0.247*** (0.075)
Log(Per cap GDP ) <sup>2</sup>	-0.008 (0.005)	0.006 (0.007)	-0.022*** (0.006)	-0.007* (0.004)	0.004 (0.005)	-0.019*** (0.005)
Log(Secondary education)	0.025*** (0.007)	0.030*** (0.009)	0.011 (0.007)	0.023*** (0.006)	0.026*** (0.008)	0.013** (0.007)
Undervaluation	-0.084*** (0.019)	-0.101*** (0.035)	-0.048** (0.021)	-0.065*** (0.017)	-0.075** (0.031)	-0.037** (0.016)
Market share	-0.001** (0.001)	-0.001 (0.001)	-0.002 (0.002)	-0.001 (0.000)	-0.000 (0.001)	-0.001 (0.001)
Relative Internet users	0.001*** (0.000)	0.001* (0.001)	0.001*** (0.000)	0.001** (0.000)	0.001 (0.000)	0.001* (0.000)
Relative Corruption index	-0.018** (0.008)	-0.024** (0.010)	0.008 (0.012)	-0.018** (0.007)	-0.020** (0.009)	-0.004 (0.011)
Conflict index	0.053 (0.059)	0.057 (0.093)	0.047 (0.062)	0.072 (0.048)	0.057 (0.074)	0.087* (0.048)
Pegged regime	0.696*** (0.080)	0.688*** (0.104)	0.588*** (0.089)	0.597*** (0.069)	0.589*** (0.048)	0.459*** (0.077)
Intermediate regime	0.690*** (0.079)	0.678*** (0.104)	0.582*** (0.090)	0.601*** (0.068)	0.592*** (0.043)	0.461*** (0.077)
Southern Africa	-0.022 (0.021)	-0.039 (0.033)	-0.023 (0.024)	0.000 (0.018)	-0.012 (0.031)	-0.002 (0.019)
Central Africa	0.036* (0.022)	0.037 (0.033)	0.013 (0.023)	0.052** (0.021)	0.064** (0.032)	0.025 (0.020)
East Africa	0.015 (0.016)	0.023 (0.024)	0.007 (0.020)	0.024* (0.015)	0.035 (0.023)	0.013 (0.018)
West Africa	-0.005 (0.016)	0.036 (0.024)	-0.056*** (0.019)	0.007 (0.015)	0.049** (0.022)	-0.036** (0.016)
Observations	2,811	1,477	1,334	2,827	1,480	1,347
Number of surges	71	39	32	60	33	27

Notes: cloglog estimates. The coefficients reported are marginal effect evaluated at the sample means. The dependent variable is a dummy that is equal to 1 over a 3-year window centered on the onset date of the surge. Controls are averages over the 7 year-period prior the surge. Standard errors are adjusted for clustering at the product-year level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.