

Algeria–Mali Trade:

The Normality of Informality

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Abstract

This paper estimates the volume of informal trade between Algeria and Mali and analyzes its determinants and mechanisms, using a multi-pronged methodology. First, we discuss how subsidy policies and the legal framework create incentives for informal trade across the Sahara. Second, we provide evidence of the importance of informal trade, drawing on satellite images and surveys with informal traders in Mali and Algeria. We estimate that the weekly turnover of informal trade fell from approximately US\$ 2 million in 2011 to US\$ 0.74 million in 2014, but continues to play a crucial role in the economies of northern Mali and southern Algeria. We also show that official trade statistics are meaningless in this context, as they capture less than 3% of total trade. Profit margins of 20-30% on informal trade contribute to explaining the relative prosperity of northern Mali. Informal trade probably plays a strong role in poverty reduction, especially in Kidal region. Finally, we provide qualitative evidence on informal trade actors and the governance and social impacts of informal trade in North Mali and South Algeria.

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Introduction

Informal trade is said to be essential to survival of the Saharan region. Among others, Scheele (2012) described with an anthropology approach, the channels of informal trade between Southern Algeria and Mali. Even if the border possesses a cartographic, administrative, and economic reality, familial and tribal links continue, making this region an environment particularly conducive to cross-border trade. For decades, informal trade has been largely tolerated on both sides of the border since, like in other regions of the world, it has enabled local populations, remote from capitals, to benefit from income generation and employment.

However, the decades-old implicit consensus was broken down some years ago due to the reemergence of armed conflicts in Mali and the subsequent events in Algeria, such as In Amenas. The official closure of the Mali-Algeria border has created an unstable equilibrium. Therefore, studying informal trade enables to better understand the social and economic risks in Northern Mali. It is even more interesting that most studies on this topic do not generate data and therefore do not necessarily explain the potential losses of revenues for Mali, the extent of subsidies from Algeria to Mali and the potential poverty impact.

Therefore, this study seeks to evaluate informal trade between Algeria and Mali and its impact on economic development and governance in northern Mali.

In this study, informal trade is defined as the flow of goods not reported or inadequately reported to customs authorities. Thus it encompasses two practices: first, the trade in goods through border posts for which false statements are made about the types or quantities of goods and, second, the smuggling of goods (i.e., when goods are passed unknown to customs authorities through or outside of border posts).²

From a methodological perspective, we used several approaches: mirror statistics, interviews of the various actors and the use of satellite images. This study was based on interviews during the spring 2014 in the sub-region and satellite pictures taken in March 2014. Contrary to other studies in this area, for security reasons, we have not been able to study smuggling at the Algeria-Mali border.

Because the statistics on seizures by security services provide only a partial view of these practices, we began by seeking to identify the relevant products; to understand the economic, geographic, and social circuits that carry them; and to gain insight into the strategies of actors operating on both sides of the borders. To this end, we conducted interviews with different population groups: economic agents, administrative managers, and local traders practicing barter or smuggling.

We collected information from institutional actors on the supply modes of the subsidized products in the region of Tamanrasset in southern Algeria. This first step allowed us to identify the links in the distribution network and the quantities traded in the region. These figures were then crosschecked with the information gathered from the interviews conducted with those practicing formal and informal³ cross-border trade in Algeria and Mali in order to understand the networks, the commodity prices, and margins. This approach allowed us to understand fairly accurately the organization of the major cross-border flows. The information gathered from the interviews on smuggling was then compared with official statistics.

The official statistics presented a puzzle: according to the Algerian authorities, Algeria showed a trade surplus with Mali, and, according to Malian authorities, Mali showed a trade surplus with Algeria. In addition, it appeared that there was no correspondence between the Malian export flows to Algeria reported by the Malian authorities and the import flows from Mali reported by the Algerian authorities.

This puzzle is explained by the fact that official statistics are extremely partial. Based on cross-checks of different sources relying on the estimated volumes, products, and destinations used in different regions of the world (see Raballand and Mjekiqi 2010; Kaminski and Mitra et al. 2012; Ayadi et al. 2014), the weekly turnover of trade in Mali in 2014 has been estimated at about US\$0.74 million,⁴

² This study does not deal directly with products whose import is illegal in Mali (weapons and drugs because collecting information and data on those products is even more difficult).

³ The traders interviewed were selected using criteria on the credibility of information and degree of involvement in informal trade.

⁴ All dollar amounts are U.S. dollars unless otherwise indicated. Conversions in this report are made on the basis of US\$1 = CFAF 480 in 2014.

and thus Malian imports can be estimated conservatively at approximately \$30 million a year.⁵ This amount is about two-thirds lower than in 2011, the peak of trade between Mali and Algeria. In 2011 imports were estimated at more than \$85 million from Algeria to Mali, with 120 trucks crossing the border each week⁶. However, Algerians officially declared \$1.02 million in exports and Malians \$1.89 million in imports in 2011, representing 1.2 percent and 2.2 percent, respectively, of the estimated volume of informal trade. Today, the margins are about 20 percent (as opposed to 30 percent in 2011).

Informal trade is very important in supplying northern Mali and allowing regions in the north to benefit from prices lower than if supplies came from the south of the country. This situation could contribute to explain why the poverty level is so low in northern Mali, especially in Kidal. Informal trade is also one of the main activities in terms of employment, in particular in the extreme north of the country.

Economically, even without considering the Algerian subsidies on transport and goods, it is understandable that Kidal, and even Gao, gravitate toward Algeria because transit times are between seven and eight days to Algiers as opposed to at least 17 days to Dakar (Senegal) or via the southern road to Abidjan (Côte d'Ivoire) or Tema (Ghana)—see table 1. Moreover, the cost of shipping transport is much lower at ports in North Africa than those in West Africa.

Table 1 Comparison of Distances and Average Transit Times from Kidal, Gao, and Bamako to Algiers, Dakar, Abidjan, and Tema

	Kidal	Gao	Bamako
Distance (km)			
Algiers (Algeria)	2,297	2,597	4,193
Dakar (Senegal)	2,950	2,650	1,400
Abidjan (Côte d'Ivoire)	2,400	2,050	1,150
Tema (Ghana)	2,250	1,900	2,000
Average transit times (days)			
Algiers	7	8	20
Dakar	18	17	13
Abidjan	23	22	19
Tema	24	23	22

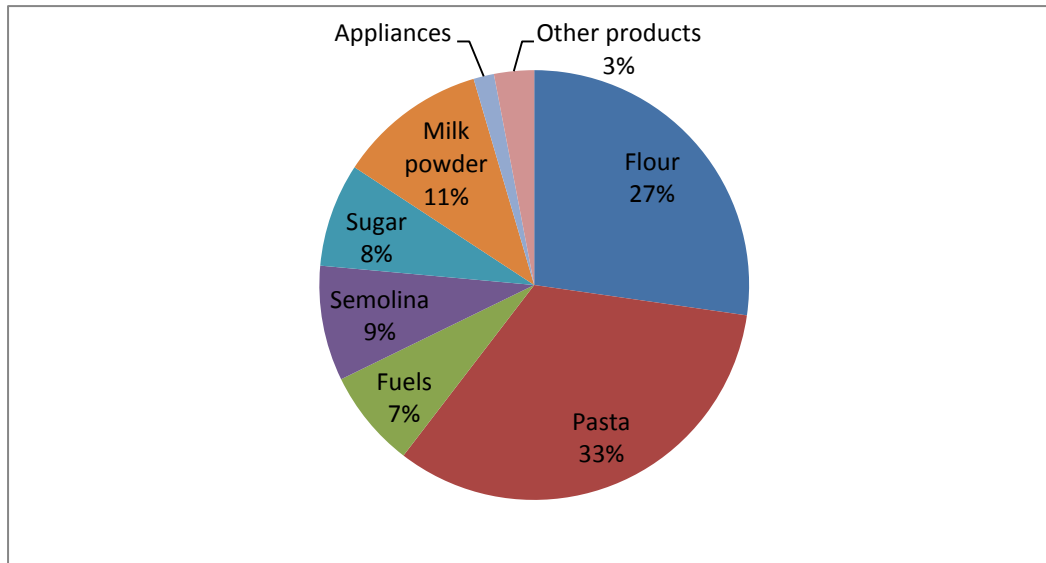
Source: Comité de liaison de la route Transsaharienne (Liaison Committee for the Trans-Saharan Road 2009).

Almost all of the products sold in northern Mali are those subsidized in Algeria— pasta products, flour, and semolina products but also fuels (see figure 1). In spite of the official closure of the Algerian border in January 2013, informal trade flows remain significant.

⁵ Estimations are based on 40 weeks because trade is very low from July to September.

⁶ On top of this, 60 trucks were crossing in transit to Niger and Nigeria.

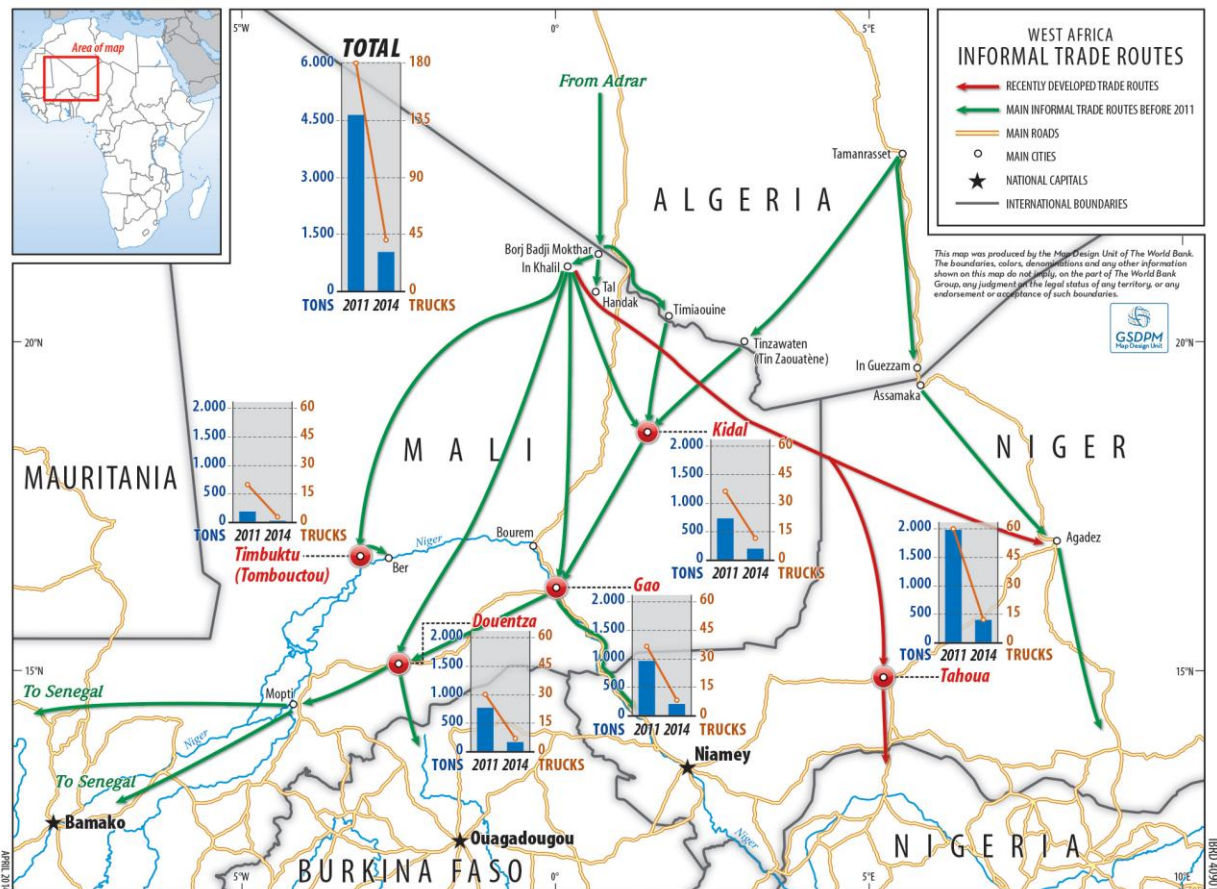
Figure 1 Breakdown of Trade Flows from Algeria to Mali, 2014 (in estimated values)



Source: Surveys conducted by the authors. 2% for appliances.

The three main border crossing points between Algeria and Mali are Bordj Badji Mokhtar in Mali, which has been somewhat superseded since 2012 by Tinzawaten and Timiaouine in Algeria (see map 1). In Bordj Badji Mokhtar, goods are kept in storage before being sent on small trucks or 4x4s to In Khalil, where they are reloaded into new trucks. Since 2011, roads have changed, and some are temporarily being used more than others because of the security situation. One of the major changes is the replacement in Mali of the hub In Khalil in favor of Tal Handak. Tal Handak is called “mini In Khalil” because of the extremely challenging security situation that has prevailed in In Khalil since the beginning of 2013. The Gao region is supplied directly from Bordj Badji Mokhtar through In Khalil, without passing through the city of Kidal.

Map 1 Informal Trade Routes between Mali and Algeria and Truck Traffic for Selected Cities, 2011 and 2014



Source: Representation of authors based on survey outcomes.

As the main findings of the study, we can highlight that informal trade had an ambivalent impact in Mali and Algeria:

- informal trade has a major positive impact on poverty reduction and economic activity in Northern Mali by generating employment and supplying cheap goods to a remote region.
- informal trade has a negative impact on governance of institutions since it creates collusion and widespread corruption in border controlling agencies, such as customs, the Army and so on... Moreover, it generates resentment in the Northern part of Mali and undermines the presence of the Malian state in the north. The Malian state is in an awkward position because it is economically legitimate for the north to be largely rooted in Algeria, but that situation reinforces, by means of corruption, the weakness of the Malian state.

In terms of policy recommendations, a fully repressive policy is not possible since it would generate more economic problems in the northern part of Mali by cutting supplies and generating more unemployment. A laissez-faire policy is not really an option as well because the trade margins are estimated \$10–15 million at a minimum (not to mention weapons or drug trafficking). Allowing smugglers to operate would undermine the integrity of state institutions (whether they be customs, the army, or even the political authorities).

Because of the economic and political importance of Algeria to northern Mali and the current issues of instability, it is important that Malian and Algerian authorities hold discussions on informal trade between the two countries. Furthermore, it is important to distinguish the different smuggling routes and potentially neglect the revenue loss aspect and better control the smuggling of illicit goods.

This paper is organized as follows. The next section describes the regulatory context and the role played by the Algerian subsidies. It is followed by our analysis of official statistics. We then present satellite images demonstrating that the closure of the border is not so effective and estimate the volume of the informal trade in 2011 and 2014 and describe the organization of the main supply chains. The next section highlights the social impact of informal trade as well as its impact in terms of governance. The last section identifies some possible policy recommendations.

Border regulation in Algeria and the issue of subsidies in southern Algeria

The *wilayas* (provinces) in southern Algeria, including Tamanrasset, have a double subsidy system: a system of compensation for transport costs is applied exclusively to these provinces and a system of subsidizing the prices of widely consumed products is applied to the entire Algerian territory.

Because of the potential impact of subsidies to neighboring countries, Algeria put in place a barter system in 1994 to regulate trade flows in order to avoid subsidizing countries, such as Mali and Niger but also Morocco and Tunisia. Moreover, subsidized goods have been prohibited for barter trade.

Finally, in January 2013, following Islamists' takeover of northern Mali and the subsequent French military intervention, the border with Mali was officially closed.

Algeria's compensation fund for transport costs

The compensation system for transport costs consists of reimbursement of the costs arising from the supply and distribution of general consumer goods at the level of the *wilayas* in the southern regions (Tamanrasset, Illizi, Adrar, Tindouf, Ouargla, Bechar, El Beidh, El Oued, Ghardaia, and Naama). This program is governed by the Executive Decree of July 10, 2007.⁷ Reimbursement covers both transport among *wilayas* and transport within *wilayas*. This scheme is intended to provide general consumer goods for people living in remote areas in southern Algeria.

The reimbursement system is calculated on the following basis: amount of compensation per operation = distance (km) × weight (tons) × DA 3 (Algerian dinars). For example, a company transporting a load of 40 tons from Tamanrasset to Alger (a distance officially estimated at 1,945 kilometers) would be entitled to reimbursement of DA 233,400 (or \$2680). However, according to

⁷ Executive Decree No. 07-216 of 25 Jumada Ethania 1428 corresponding to July 10, 2007, supplementing Executive Decree No. 97-53 of 5 Chaoual 1417 corresponding to February 12, 1997, establishing the operating procedures of the account for special assignment no. 302-041, called "Compensation funds to transport costs," JORADP no. 46, p. 3.

interviewees, the real price of transportation is DA 180,000 (or \$2070), which means that there is a significant profit for the transporter, who has an incentive to transport goods between both cities. In 2013 DA 979,309,333 (or approximately \$12.5 million) was budgeted for this program. Nearly a quarter of that amount was earmarked for the Tamanrasset *wilaya*.

The importance of consumer subsidies in Algeria

In Algeria, the main subsidized products are the following:

- Normal semolina: DA 900 per 25 kilograms (\$10.3)⁸,
- Superior quality semolina: DA 1,000 per 25 kilograms (\$11.5),
- Milk: DA 25 per liter (\$0.3),
- Flour: DA 2,000 per 100 kilograms (bakers), DA 2,080 per 100 kilograms (retailers), DA 2,180 per 100 kilograms (consumers) (or \$23, \$23.9 and \$25.1),
- Sugar: between DA 90 and DA 95 per kilogram (\$1 and 1.05),
- Oil: DA 600 per 50 liters, DA 250 per 2 liters, DA 125 per 1 liter (\$6.9 for 50 litres),
- Cement: price of cement is not defined but high profit margins are fixed to DA 40 per 25 kilograms (wholesalers) (or \$0.5 per kilogram) and DA 80 per 25 kilograms (retailers).

The budget allocation for subsidized products is not based on a study of actual consumption needs. Each wholesaler legally registered and not considered a smuggler is entitled to claim this refund, whatever the number of transactions and the amount of products shipped. When the refunds requested exceed the allocated budget, the outstanding amounts are rolled over to the following year. Until 2013, this process generated a cumulated debt of more than DA 1.8 billion that the directorate of trade gradually wrote off through the compensation fund (nearly \$25 million).⁹

Fuel is very heavily subsidized in Algeria. Throughout the country, regular gasoline sells for DA 21.20 (\$0.27) per liter, super for DA 23 (\$0.29) per liter, and diesel for DA 13.70 (\$0.17) per liter. The selling price in Mali was over \$1.4 per liter in 2012.

In border localities, each identified operator is limited in the quantities of subsidized products that can be traded in these regions. But this scheme does not limit number of traders who are able to register for this activity, and thus it does not limit the threshold for allocations in border areas.

Border control on the Algerian side

The border between Algeria and Mali is 1,376 kilometers long. Surveillance of the southern Algerian border is difficult because the population density is very low, particularly in the far south. Algeria's border with Niger is 956 kilometers. These borders cover a Saharan region crossed by tracks used by traders.

⁸ Exchange rates used in this study are the following for Algerian dinars : 75 Algerian dinars for \$1 in 2011 and 87 Algerian dinars for \$1 in 2014.

⁹ A project currently being studied would streamline the process and limit reimbursements up to the annual available budgets, but its implementation appears to be difficult. Algerians consider the system of compensation of transport costs to be a right, and any effort to change it could spark a strong social reaction.

The conflict that has prevailed in northern Mali since January 2012 has upset the trade balances between Algeria and Mali. Algeria officially closed its southern border in January 2013 to prevent any incursions from Islamists who allegedly fled Mali after the 2012 French military intervention. In addition, on July 14, 2013, Algeria's Council of Ministers adopted measures to limit fuel smuggling at borders because of its scale across the country. In addition to their operational provisions, the adopted measures, still in force, were intended to control the distribution of fuel at gas stations by mandating the following:

- Instigating controls by police services of all gas stations, including those inside the country,
- Implementing a reporting system to identify suspicious vehicles repeatedly passing the border,
- Controlling allocations of fuel to *fellah* (farmers),
- Banning the allocation at gas stations of fuel to people with tanks and containers.

The sub-region has agreements on border management: an Algerian-Nigerien border committee and an Algerian-Malian joint commission on security.

Implementation of Organization of African Unity (OAU) resolutions enabled the conclusion, without any major difficulty, of the agreement on Algeria's demarcation border with Niger on January 5, 1983, and with Mali on May 8, 1983.¹⁰ The Algerian-Malian joint commission on security is an administrative and executive entity created by Algeria and Mali to oversee the different aspects of cooperation in terms of security in the border regions, but it convenes only once every three years and therefore is virtually nonexistent.¹¹

This supranational cooperation is supplemented by control and surveillance on the Algerian side. The adopted security strategy heavily relies on the control and surveillance of the territory by both the military and police.

Within the framework of its modernization program (2007–10), Algerian customs has undertaken extensive recruitment, adding more than 20,000 customs officers in 2012 and maintaining its level of recruitment in order to conduct surveillance in the southern regions. This system was reinforced by opening land border posts for control of people and goods.¹² Twenty-six customs stations are spread across the borders (8 posts at the border in the east, 14 in the south, and 4 in the west), and surveillance posts exclusively oversee surveillance of border areas.

¹⁰ Decree No. 83-380 of May, 28 1983, on the ratification of the convention relating to the demarcation of the state border between the People's Democratic Republic of Algeria and the Republic of Mali, signed in Algiers on May 8, 1983 (OJ No. 23 of June 4, 1983, p. 1043).

¹¹ Decree No. 83-400 of June 18, 1983, on the ratification of the convention on mutual administrative assistance in customs matters between the People's Democratic Republic of Algeria and the Republic of Mali, signed in Bamako on December 4, 1981 (OJ No. 26 of June 21, 1983, p. 1142).

¹² Decision of October 22, 2005, on the land border customs stations (OJ No. 25 of April 19, 2006, p. 26).

These measures are legally supported by the adoption of a specific law reinforcing sanctions against all forms of smuggling.¹³ These sanctions are warranted against serious forms of smuggling (weapons, drugs, etc.), but they seem disproportionate for the traffic of consumer products intended to supply isolated localities in the Sahara. The prescribed penalties are 10–20 years in prison, a fine equivalent to 10 times the cumulated value of the goods, means of transport and penalties (Article 12). This repressive policy, which was originally intended to be dissuasive, could reverse the risk/benefit ratio and shift the orientation of smugglers toward more profitable forms of trafficking.

Regulation by barter trade and exchange controls

Several trade agreements have been signed between Algeria and Mali¹⁴ and between Algeria and Niger. The suspension in Algeria of the international transit regime (after alleged fraud) marked the end of the official massive supply of Mali and Niger through Algerian ports.

The institutional response of the Algerian state was essentially based on border security, regulation, and control of the barter trade that remains operational (only with Niger). However, twice a month the Algerian authorities open the borders for the supply of local populations through barter trade.

The inconvertibility of the Algerian dinar introduced shortly after the country's independence has forced operators to trade in the form of barter: the proceeds from the sale of a product allows the purchase of another one. Sectors operating per group of products have therefore been created: dates–agricultural products, salt–livestock, construction materials–products from Nigerian industry, and so forth (Grégoire 1998).

Barter trade has been established via a unilateral Algerian regulation.¹⁵ It is a system set up by Algerian authorities (Ministry of Trade) to try to “normalize” one “legitimate” practice based on the traditional trade ties between Algeria and West Africa dating from long before the colonial period and the constitution of the Algerian state. Officially, the barter trade has been falling since 2011, from \$3.4 million in 2011 to \$700,000 in 2013.

¹³ Order No. 05-06 of August 23, 2005, on the fight against smuggling (OJ No. 59 of August 28, 2005, p. 3).

¹⁴ Order No. 75-71 of November 12, 1975, on the ratification of the agreement on road transport of goods, payment, between the People's Democratic Republic of Algeria and the Republic of Mali, signed in Bamako on June 30, 1975 (OJ No. 99 of December 12, 1975, p. 1056); Decree No. 83-341 of May 21, 1983, on the ratification of trade and tariff agreement between the government of the People's Democratic Republic of Algeria and the government of the Republic of Mali, signed in Mali on December 4, 1981 (OJ No. 21 of May 24, 1983, p. 977); Presidential Decree No. 01-80 of March 29, 2001, on ratification of trade and tariff agreement between the government of the People's Democratic Republic of Algeria and the government of the Republic of Mali, signed in Bamako on July 11, 1996 (OJ No. 20 of April 8, 2001, p. 3).

¹⁵ Section 128 of the Finance Act 1994 and the Decree Inter. of December 14, 1994, setting out the arrangements for exercising the barter trade with Niger and Mali (OJ No. 7 of February 15, 1995, p. 30) and repealing the decree of April 5, 1991, fixing the conditions and terms of import and export of goods under the barter trade border with Mali (OJ No. 29 of June 12, 1991, p. 914). In addition to this regulation, several decrees were added regulating the fair of Assehar in Tamanrasset. According to an official of the Ministry of Commerce, Algeria invited Malians and Nigeriens to conclude an international agreement between the three states—a legal form more appropriate to regulating cross-border trade. Neither country accepted this proposal. As members of the Economic Community of West African States (ECOWAS) they cannot, because of this status, unilaterally agree to preferential trade agreements outside of this economic area.

In the order of 1994, the main text regulating barter trade stresses in its two first sections the exceptional nature of barter trade.¹⁶ This system tries to regulate barter trade strictly while providing local administrative authorities with wide power of management and control. Under this same system, a balance between import and export values within the framework of barter trade must be strictly observed; the proceeds from the sale of Malian and Nigerien goods can only be allocated to the purchase of Algerian goods included in the list and the amount of purchased goods for export must not be higher than declared on entry (article 8). The order of 1994 set out the list of goods admitted under the barter on a tax and duties suspension basis. The geographical space was set to the terrestrial boundaries of the *wilayas* of Adrar, Tamanrasset, and Illizi. The order of 1999 extended the boundaries to the *wilayas* in Tindouf.¹⁷ The Algerian products authorized for barter are common dates; frezza dates, to the exclusion of other varieties of deglet nour dates; domestic salt; household objects made of plastic, aluminum, cast iron, iron, and steel; blankets; and local crafts, excluding wool rugs. The authorized products from Mali and Niger are livestock, henna, green tea, spices, turban fabric, Tarri fabric, mil, rancid butter for local consumption, dried vegetables, rice, and mango. Since the closure of the borders, only dried dates are allowed for export.

To exercise barter trade, a trader must, under the order of 1994, seek inclusion on Algeria's trade register as a wholesaler and possess storage infrastructure and a means of transporting goods, owned or rented (article 4). This measure has created a monopoly of Algerian traders in the wholesale cross-border trade, thereby forcing Malians and Nigeriens to go through these Algerian intermediaries (Scheele 2012).

Procedures relating to barter trade are largely decentralized. Pursuant to the order of 1994, the *wali* (prefect) has wide discretionary power, depending on the local situation, and he sets the quantities of goods authorized for import (article 3, para. 2). Once a year, he also sets the list of wholesalers responsible for conducting border barter trade (article 5). He may also decide to withdraw permission from traders who are operating for a third party or are not complying with the commercial, customs, or tax law in force or who have not carried out import or export operations during the year (article 6). Local trade, customs, and tax services are responsible for fixing price ranges and periodically evaluating the conditions for the implementation of activity (article 12).

To ensure a strict trade balance, customs services maintain a tracking sheet of the transactions of each trader. At the end of the year, to comply with barter regulation, each operator who has not balanced its operations has to address the gap the following year under penalty of registration suspension.

¹⁶ "The barter trade is exceptional in nature and is intended to facilitate the supply of the only people who reside in the wilaya of Adrar, Illizi of Tamaneghasset and Tindouf," says article 2 of the Decree Inter. of December 14, 1994, laying down the procedures for the exercise of cross-border trade barter with Niger and Mali, amended by Decree Inter. of April 12, 1999 (OJ No. 35 of May 19, 1999, p. 13).

¹⁷ Order Inter. of April 12, 1999, amending and supplementing the inter-ministerial order of 10 Rajab 1415 corresponding to December 14, 1994, laying down the procedures for the exercise of cross-border barter trade with Niger and Mali (OJ No. 35 of May 19, 1999, p. 13).

Weaknesses and imbalance of official trade

To get an overview of trade between Algeria and Mali, and identify the most traded goods, we analyzed official statistics in the COMTRADE database, based on customs declarations of both countries.

According to official statistics, trade between Algeria and Mali is extremely low. When analyzing official statistics, it seemed that there was an enigma because according to Algerian authorities, Algeria had a trade surplus with Mali and by the Malian authorities, Mali had a trade surplus with Algeria.

According to Algerian official statistics, barter trade increased from \$1.46 million in 2000 to over \$6 million in 2010 in imports and from \$742,000 in 2000 to over \$5 million in 2010 in exports (for Niger and Mali).

There appeared to be no correspondence between the flow of Malian exports to Algeria reported by the Malian authorities and the flow of imports from reported by the Algerian authorities Mali. COMTRADE, however, finds that figures differ. The available trade data between Algeria and Mali are fluctuating and not reliable¹⁸. The transaction values recorded by the two countries are very different: Malian authorities recorded imports of over \$1.89 million in 2011, whereas Algerian authorities recorded a total value of only \$1.02 million for the same year. Similarly, Malian authorities recorded exports of more than \$11.5 million in 2011, whereas Algerian authorities recorded a value of only \$0.10 million in imports for the same year.

Table 2 summarizes the total trade flows between Algeria and Mali based on the customs declarations by COMTRADE.

Table 2 Total Recorded Trade Flows: Algeria and Mali, 2007–12

US\$ millions

Year	Algerian exports (recorded value on entry in Mali)	Algerian exports (recorded value when leaving Algeria)	Malian exports (recorded value on entry in Algeria)	Malian exports (recorded value when leaving Mali)
2007	1.32	0.62	0.16	1.95
2008	4.94	0.64	0.00	2.39
2009	0.00	2.65	0.00	0.00
2010	1.54	0.27	0.00	3.11
2011	1.89	1.02	0.10	11.57
2012	1.84	0.58	0.25	1.85

Source: COMTRADE.

In 2007 Malian authorities recorded the entry of 13 different types of goods, whereas the Algerian authorities recorded the export of 141 different types of goods for the same year (see table 3). As for Malian exports to Algeria, there is a low flow of registered trade, except for the year 2011 when

¹⁸ For more details on the methodology, see annex A.

42 types of exports were recorded on the Malian side, whereas Algeria recorded receiving only 4 imports from Mali (see table 3).

Table 3 Range of Goods Exchanged between Algeria and Mali, 2007–12

	Number of imported goods recorded by Malian authorities	Number of exported goods recorded by Algerian authorities	Number of Malian exports recorded (to Algeria)	Number of Algerian imports recorded (from Mali)
2007	13	141	2	7
2008	149	21	8	1
2009	0	30	0	4
2010	35	27	6	0
2011	52	31	42	4
2012	59	70	6	4

Source: COMTRADE.

Where correspondence does exist between the exported goods reported by Algerian authorities and Malian imports, some wide disparities may be evident. Dates, for example, represent the largest volume of business, with an import value in 2011 of over \$947,000 or approximately nine times the export value, \$107,840. However, the main discrepancies in trade in 2011 can be found for mineral water and the equipment needed to purify water¹⁹. The trade gap is more than 120 times the import value of mineral water and 880 times the import value of purification equipment.²⁰ According to Algerian authorities, in five years out of six the most commonly exported goods are medical needles and other organic materials (HS6 294200), followed by water purification machines, salt, and vegetable oils (HS 151590 and 151790).²¹

According to Malian authorities, Malian exports are dominated by fruit exports, guava and mango, which, with a value of more than \$2 million in 2011, had the highest export value between 2007 and 2012. According to Algerian authorities, cotton (HS 520100) was the main Malian export over the study period, with a value of \$2.5 million in 2012.

In the official trade statistics, the fuel trade has extremely low values. Algerians declare that gasoline exports (HS 271000) amounted to \$14,238 in 2007 and \$7,105 in 2010. Malians declare that gasoline imports (HS 271000) amounted to \$19,064 in 2011 and gas imports (HS 271129) amounted to \$623 in 2008. No exports of cigarettes from Algeria are recorded. Annex C reveals Malian imports of cigarettes and gasoline in the official statistics as well as their total value and tonnage.

¹⁹ For a detailed list of official traded goods, see annex B.

²⁰ These flows correspond to the humanitarian aid Algeria sent to Mali in 2011 in the water and health sectors, specially targeting regions in northern Mali (*El Watan* 2011).

²¹ HS refers to the Harmonized Code.

The reality: Smuggling, a normality in northern Mali

In spite of the border closure, smuggling continues between Algeria and Mali (although volumes have fallen sharply since 2011). The explanation lies in the fact that the economic integration of northern Mali and Algeria is economically rational.

The evidence produced by satellite images

To examine the presence of informal trade routes across the border, we commissioned a set of satellite images. The images were taken in March 2014, with a resolution of 50 cm and are 100% cloud free. As trucks and cars leave marks in dry terrain, the images bear witness of the transport activity around the border.

A sophisticated algorithm was used to identify informal roads on satellite images²². A first automated data extraction of road traces was followed by a manual process (roads digitization and importance qualification) to extract alternative roads from the large dataset. This manual process helps to connect roads, close gaps generated by the automated process and remove some false road segments that were identified along geological or topological edges²³.

Informal roads were classified as minor or major, based on the visible depth of the traces and the number of parallel/adjacent traces clustered together (images 1 and 2). As a rule of thumb, when several traces (8 or more) were visible and organized in a cluster (as shown on the following example), the road was classified in the “major” category. In some areas, when the trace was very deep (roads used several times by different vehicles), the road was also classified as major (otherwise they were classified as minor).

The satellite maps indicate intense trading activity around the Algeria-Mali border, despite its official closure. Maps 1 and 2 display major (red) and minor (green) off roads and the official roads (black dotted lines) around the border towns of Bordj Badji Mokhtar and In Khalil. Both major and minor roads are numerous. Over a distance of 2 kilometers, there are at least 3 major routes (in red) over the border going/from Bordj Badji Mokhtar.

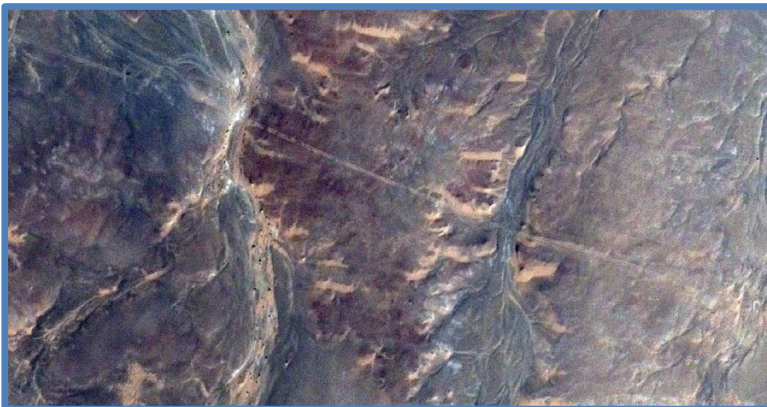
²² For more details on the methodology, see annex D.

²³ Due to arid terrain, traces remain present on satellite images for weeks or even months depending on the depth of the trace.

Image 1 Satellite image of a major informal road



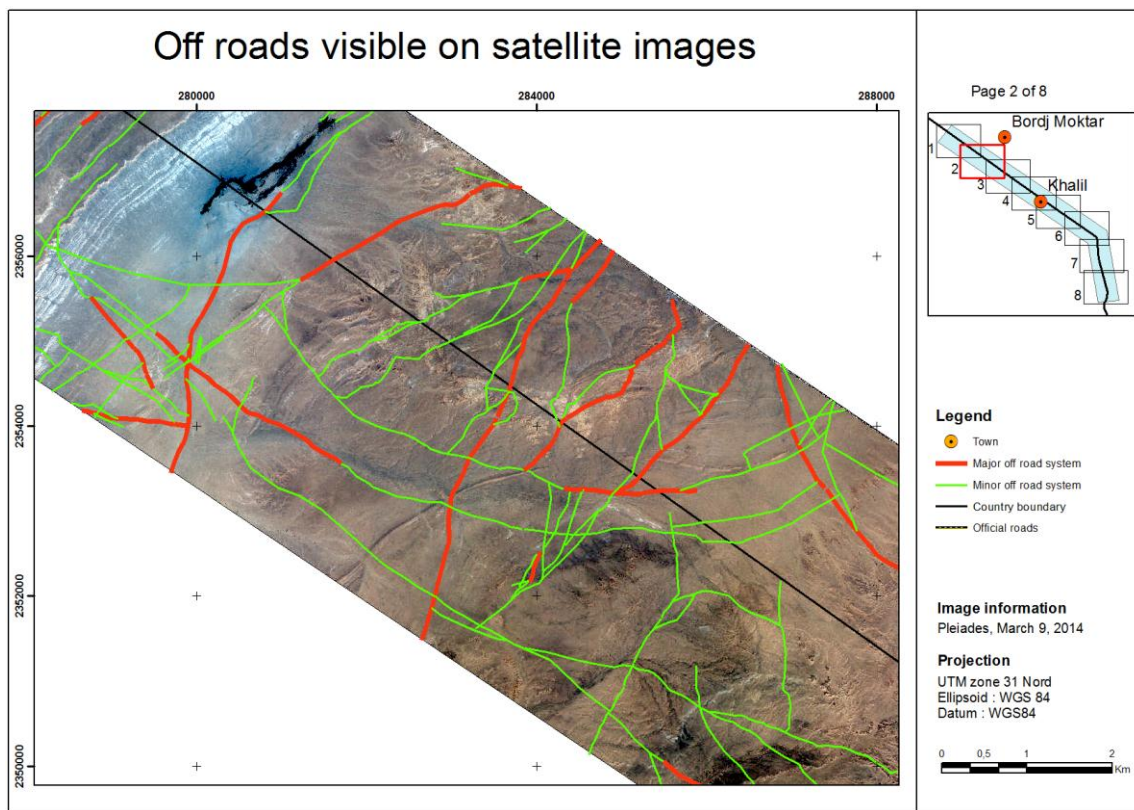
Image 2 Satellite image of a minor informal road (one trace)



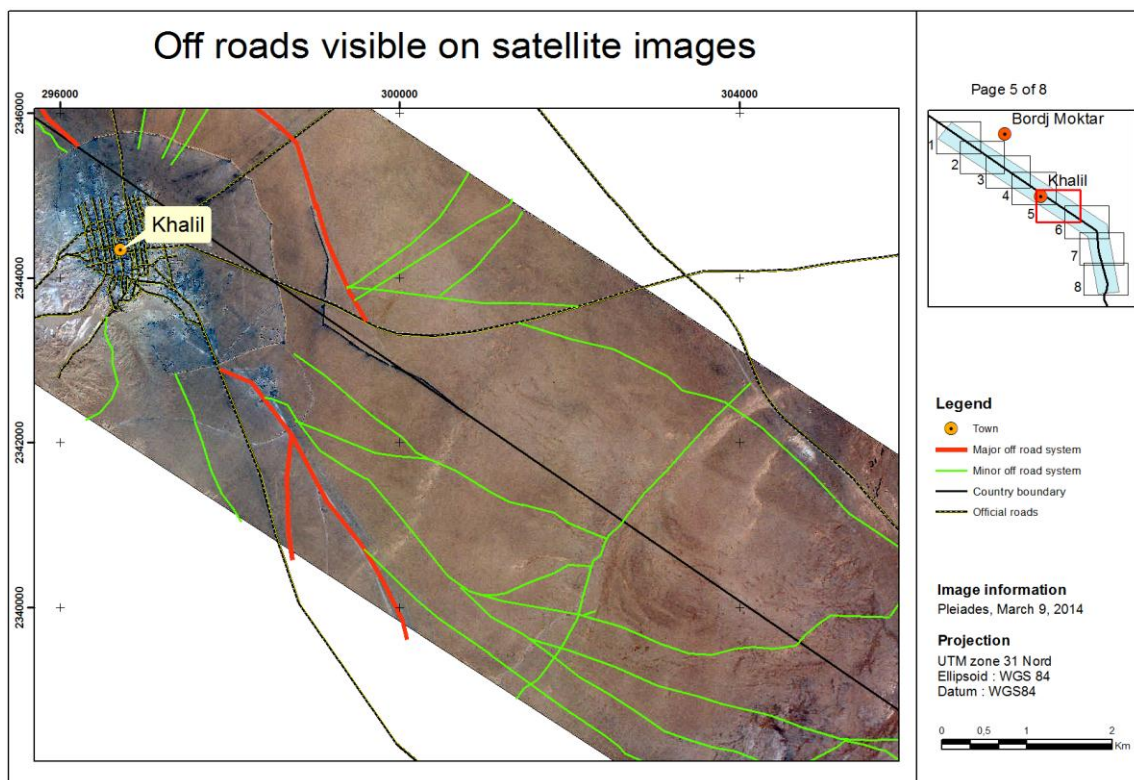
Maps 2 and 3 show the many roads that exist beyond the “official” roads (the black line in the middle of the image is the border between Algeria and Mali). Over a distance of 2 kilometers, at least three major routes (in red) cross the border near Bordj Badji Mokhtar.

Therefore, despite official closure of the border, several trucks or cars are likely to go through the border every day in the vicinity of Bordj Badji Mokhtar.

Map 2 Informal routes around Bordj Badji Mokhtar



Map 3 Informal routes around In Khalil



Estimating the volume of informal trade

Northern Mali largely lives on informal trade, described as smuggling, which is largely permitted for all products with the exception of fuel and illegal products such as weapons and drugs. The only trade authorized between Algeria and Mali is that in dates. All other trade is defined as smuggling by Algerians. Almost all of the consumer products in northern Mali are from Algeria, in particular in the Kidal region. However, the Timbuktu region also imports products from Mauritania (sugar and carpets) and from Niger (smuggled gasoline). A significant part of smuggled products are shipped to Bamako, especially flour, pasta, oil, and appliances.

In this section, we estimate the annual turnover in informal trade, focusing on flows into Mali. This estimation of volumes (and profits) necessarily has a margin of error because of a lack of available data. Our calculation is based on statements by traders and customs officers who were interviewed on the number of vehicles crossing the border per week in 2011 and 2014, their destination, and their selling price in different cities. Averages were then calculated, giving more weight to interviewees who were considered the most reliable and the most involved in the trade. Based on interviews on the means of transport, assumptions were made on unit tonnage and overloads. It was thus possible to calculate the turnover per product per city per week and per year.

According to the interviews, 180 trucks per week in “normal time”—that is, in 2011—crossed the Algerian-Malian border. The distribution of trade flow between the cities and the category of trucks used was as follows: Timbuktu, 20 trucks (10 tons only); Kidal, 35 trucks (20 tons at 70 percent); Gao, 35 trucks (20 tons at 70 percent); Bamako, 30 trucks (mainly 20 tons); and Niger and Nigeria, 60 trucks (40 tons at 80 percent). Niger is *de facto* the main transit country for Nigerians imports from Algeria but part of it transits first in Mali.

The breakdown per good is as follows: 35 trucks of flour, 30 trucks of pasta, 25 trucks of semolina, 20 trucks of other staple products (oil, drinks, sugar, and milk powder), 30 trucks of fuel, 30 trucks of dates, 5 trucks of appliances, and 5 trucks of other products.

Given the unit volume, the goods traded between Algeria and Mali represented a weekly volume of 4,640 tons: 750 tons for the Kidal region, 930 tons for the Gao region, 200 tons for the Timbuktu region, 770 tons for Bamako, and 1,990 tons for Niger and Nigeria. Because trucks can be overloaded, 25 percent should be added to the average (a 10-ton truck will carry up to 13 tons). Table 4 provides details on the prices and quantities per good and city.

Table 4 Prices and Weekly Quantities of Consumer Goods by City 2011

		(1)		(2)		(3)		(4)		(5)		(6)	(7)	(8)	(9)
Product	Price in Bordj Badji Mokhtar (per ton)	Kidal		Gao		Timbuktu		Bamako		Niger (Niamey and Tahoua and Agadez.)		Total quantiy	Total quantiy (Mali)	Total turnover (in million CFAF)	Total turnover Mali (in million CFAF)
		Price (per ton)	Qty	Price	Qty	Price	Qty	Price	Qty	Price	Qty				
Flour	170,000	230,000	107	280,000	195	320,000	40	480,000	200	470,000 (Niamey) 360,000 (Tahoua)	500	1042	542	401	188
Pasta	270,000	350,000	140	420,000	170	450,000	30	560,000	100	460,000	640	1080	440	483.4	189
Dates	270,000	ns	ns	486,000	60	ns	ns	700,000	200	500,000	340	600	260	339.2	169.2
Wheat semolina	120,000	160,000	170	200,000	215	240,000	40	350,000	70	240,000	330	825	495	183.5	104.3
Milk	1,400,000	1,583,000	10	1,900,000	40	2100,000	0	2,500,000	30			80	80	166.8	166.8
Diesel	200,000	250,000	143	300,000	100	350,000	40	350,000 (region of Mopti)	100	360.000	100	583	483	150.7	114.7
Gasoline	400.000	525.000	100	Imported from Niger	0	----	0	-----	0						
Sugar	310.000	350,000	30	400,000	70	400,000 (from Mauritania)	0	600,000	0	540,000	80	180	100	81.7	38.5
Appliances	150,000	190,000	10	230,000	30	280,000	30	588,000	40			110	110	40.7	40.7
Other products	400,000	440,000	40	480,000	50	550,000	20	600,000	30			140	140	70.6	70.6
Total			750		930		200		770		1,990	4,640	2,650	1917.6	1081.8

Prices are in CFAF, All quantities are in tons

Source: authors' computations based on interviews.

The total informal trade between Algeria and Mali in 2011 was estimated at over \$85 million but declined to less than \$30 million in Mali in 2014 (see the details of the calculation in box 1). This revenue has therefore fallen by about two-thirds since 2011, the peak of trade between Algeria and Mali.

Official statistics seem totally inadequate because in 2011 Algerians officially reported \$1.02 million in Malian exports and Malians reported \$1.89 million in imports the same year, representing 1.2 percent and 2.2 percent, respectively, of the estimated volume of informal trade.

If we include informal trade to Niger and Nigeria, informal trade volume amounted to over \$150 million.

Box 1 Detailed Estimates of Revenue from Smuggling to Mali in 2011 and 2014

Informations from interviews (weekly figures):

- **Number of trucks** : 180 (2011), 40 (2014).

Breakdown of trucks : 2011 : Timbuktu : 20 trucks (10-ton only) ; Kidal: 35 trucks (70% 20-ton, 10% 10-ton, 15% 30-ton and 5% 40-ton) ; Gao: 35 trucks (70% 20-ton and 30% 40-ton) ; Bamako: 30 trucks (20-ton) ; Niger and Nigeria : 60 trucks (80% 40-ton).
= total tonnage **4600t (2650 tons for Mali)**.

- **Breakdown of goods** :

2011 : 35 trucks of flour, 30 trucks of pasta, 25 trucks of semolina, 20 trucks of other food products (oil, drinks, sugar, milk powder, etc.), 30 trucks of fuel, 30 trucks of date, 5 trucks of appliances and 5 trucks of other products.

2014 : 14 trucks of flour, 10 trucks of pasta, 4 trucks of semolina, 5 trucks of fuel, 3 trucks of sugar, 1 truck of milk powder, 1 truck of appliances and 2 trucks of other products.

- **Decrease of trade volumes and inflation between 2011 and 2014 (as indicated below).**

- **Exchange rate: 506 CFAF per \$1 in 2011 and 480 CFAF in 2014.**

- **Seasonality** : trade is really low from July to September, therefore, estimates are based on 40 weeks.

Computations for 2011 (table 5):

- From the number of trucks/breakdown per product, we compute turnover per product per city (columns 1-5).

- The sum of imports from various cities gives the total quantity per product (column 6).

- For each product, we multiply tonnage per price for each city and have turnover (column 8).

- Columns 7 and 9 exclude goods to Niger and Nigeria.

These estimations appear to be relatively low when compared with those for countries with weak governance where the same type of estimation was undertaken and therefore those estimates are probably conservative. In regional comparison, informal imports are now lower in Mal²⁴i with \$45 per capita compared to Tunisia (\$120) but were almost similar in 2011 with \$125 per capita. It

²⁴ Data have been computed using figures for the population of the North Mali (since a vast majority is consumed in the Northern part of Mali).

remains however lower than Nigeria (\$250) but it is probably due to the fact that trade policy is much more restrictive in Nigeria than Mali or Tunisia²⁵.

Decrease in flows since 2011

The smuggling market has been significantly disrupted since 2012 and the rebellion in northern Mali. Informal trade in northern Mali underwent a multifaceted crisis: a decrease in demand because of the outflow of refugees and displaced people out of Mali beginning in 2012; a decrease in supplies because traders fled to Mauritania or Niger, or were displaced in Bamako; growing insecurity about the commercial routes that discourages some traders still living in northern Mali; and finally the closure of the Algerian border, which has drastically reduced trade volumes since early 2013. Estimates are presented in details in Table 5.

Table 5 : Estimates of turnover in 2014

Product	Turnover in 2011 (million FCFA)	Trade decrease (%)	Inflation (%)	Turnover in 2014 (million FCFA)
Flour	188	60	30	97.8
Pasta	189	66	30 (45 in Timbuktu)	83.5
Semolina	104.3	84	75 (230 in Timbuktu)	29.2
Fuel	114.7	84	100	18.4
Sugar	38.5	50	25	24.1
Milk powder	166.8	80	120	73.4
Date	169.2	100		0
Appliances	40.7	80	25	10.2
Other	70.6	80	40	19.8
TOTAL	1081.8			356.3

Dara source: interviews.

Some products are now traded at very low volumes, starting with diesel and gasoline. Both are subject to vigorous control by the Algerian security services, leading to inflation. This control is also applied to semolina, leading to shortages in the three northern regions. The closure of the Algerian border has had the direct effect of diverting all trucks shipping dates—the only authorized product to be exported to Algeria—toward the Niger border.

The trade flows evident as of early 2014 can in no way be compared with those recorded in a time of peace. The drop in turnover has been estimated at 67 percent. The closure of the Algerian border caused a substantial increase in prices, which did not necessarily lead to higher margins from merchants in northern Mali. The recorded inflation was the impact of a decrease in supply and in particular an increase in prices at the Algerian border. The main commercial consequence of this situation was the reduction of market opportunities for products from northern Mali.

²⁵ Source for Nigeria (in particular Lagos region): Raballand and Mjekiqi 2010; Tunisia: Ayadi et al. 2014; Figures are for all major imported products.

Some products turn out to be uncompetitive in Bamako, such as milk powder, which is now cheaper in Bamako (CFAF 35,500 per carton) than in Timbuktu (CFAF 50,000 per carton). Other products that have undergone significant inflation in the north have seen their prices stagnate or even decline in Bamako. A ton of flour now costs CFAF 450,000 in Bamako because it has been subject to inflation of 30 percent in the three northern regions since 2011. A ton of sugar is now traded at CFAF 500,000, increasing by 25 percent in the three northern regions. The diversification of supplies in southern Mali has led to a trend of price stability and prevents the trading of products from the Algerian contraband. Products that continue to be shipped in small quantities in the north and south are mainly flour, pasta, sugar, and other products such as oil and appliances.

Smuggling supply chains: How they work

The *modus operandi* of smugglers is different according to the type of traffic considered. For food staples or consumer goods, smuggling is conducted openly by truck by day, with the exception of fuel which requires more caution by smugglers because of the firmness of the Algerian authorities about this product.

Between 15 and 20 percent of goods smuggled from Algeria end up in the south of Gao and in Douentza, Mopti, and the southern part of Mali. A significant portion of flour imported from Algeria supplies bakeries in Bamako, Niamey, and Tahoua in Mali and Agadez in northern Niger. The majority of imported pasta makes its way to the Nigerien market, as well as the majority of dates imported to Mali that ultimately reach the south of Mali toward Senegal and Guinea. In Mali, all goods continue their journey until at least Mopti and Douentza. As noted, some products, such as pasta, flour, semolina, and appliances, are even transported to Bamako. However, fuel stops at Douentza and will sometimes be smuggled into Burkina Faso. The existence of a road linking In Khalil to Tahoua and Agadez in Niger may be surprising given that In Guezzam, at the Algeria-Niger border, is a commercial hub that more directly supplies northern Niger from Algeria. It turns out that, even though the In Khalil-Taouha/Agadez road is longer and more costly than the Niger road via In Guezzam and Assamaka, goods are more easily shipped fraudulently on the Malian side according to smugglers.

The network structure differs across sectors. In the area of food products, the networks are widely family-based because of the family relationships on both sides of the border. The trust that characterizes these relationships is reflected in the *hawala* payment mode.²⁶

For cigarettes, drugs, and fuel, the situation is different. Payment is made in cash or by bank transfer (for cigarettes), and recruitment within sectors is carried out on an individual basis, even if the heads of sectors in Mali and Algeria have a family relationship.

The main products exported (smuggled) from Algeria to Mali are food (dates, flour, pasta, semolina, and milk powder) and gasoline, followed by consumer goods (appliances). In export volume, these

²⁶ The *hawala* system is an informal money transfer system within a network based on trust and honor among money brokers located in different countries. The advantage is that it is not necessary to actually move money, especially in a difficult security environment, and one can limit taxes.

products exceed the volume of Malian imports, which mainly consist of livestock products (sheep and camels) and bazin (traditional fabric), as well as Chinese green tea and cigarettes. Most of the trucks returning to Algeria from Mali are loaded with livestock collected along the route to Algeria.

Traders often import several types of cargoes including fuel barrels. It is estimated that 90 percent of supplies are preordered, a growing trend since the introduction of mobile and satellite phone to the “professional” structure of networks.

Smuggling food products

On the Malian side, the town of In Khalil²⁷ is still the main trading hub in northern Mali, where a large portion of the goods is centralized.

The smuggling of flour dominates fraud in this area probably because of its high margins. Pasta, semolina, and oil are also among the most traded products, whereas milk is often marketed only because of the prospect of getting a “passe-avant” (a circulation license of goods subject to duties and taxes) in Adrar or Tamanrasset (however, this arrangement is no longer profitable). Using a passe-avant, a trader can ship subsidized goods (that will partly be sold in Mali or Niger) into the Algerian territory.

Fuel smuggling from Algeria

Fuel smuggling is popular in the region because of the availability of fuel and its low selling price in Algeria. The smuggling routes have been adjusted to modes of supply and established control systems.

From the town of Tamanrasset, the latest control measures led to a change in the patterns of fuel smuggling. The controls at gas stations forced smugglers to collect and store fuel at their places of residence. This contraband is concentrated in a neighborhood in the north of Tamanrasset largely controlled by a family. These family members also participate in the barter trade and trade of consumer goods.

The fuel quantities seized by the security services in the entire region of Tamanrasset seem quite modest compared with the quantities actually exported via smuggling. Seizures in 2013 represented only 10 percent of smuggled fuel from one locality of In Guezzam (according to estimates).

The *wilaya* of Tamanrasset has 14 gas stations, including two in Tinzawaten 9 kilometers from the border with Mali and a Naftal station, which has a monopoly on the distribution of fuel and petroleum derivatives.

Petrol is allocated to stations as requested. Supply quantities are not limited, and no study of the real needs in fuel consumption has apparently been conducted at the level of the *wilaya* in Tamanrasset. Only localities near the borders (In Guezzam and Tinzawaten) are subject to a

²⁷ The city is a storage and transit site, mostly controlled by the Touareg Idnan related to the National Movement for the Liberation of Azawad (MNLA) and by the Berabiches Arabs from the region of Timbuktu. Tal Handak is currently controlled by the MNLA and is mainly held by traders Kunta and Ifoghas.

restricted allocation. The monthly quantities of authorized fuel in these areas are determined by the *wali* and transported from Tamanrasset under escort of the gendarmerie.²⁸

Convoys (of contraband)²⁹ are typically composed of groups of 8–20 all-terrain vehicles belonging to different people. This *modus operandi* allows an owner to spread the risks by shipping only part of his "fleet" per operation, thereby limiting his vulnerability to possible interception by the customs services. This also creates a kind of community of interest and thus reduces the risk of competition and denunciations.

The most significant profits are made at the level of the two most structured parts of the network: gas stations (main sites for supplies) and organized networks of cross-border transport.

Cement smuggling

This traffic is rapidly expanding to Niger as indicated by the statistics of customs services; quantities of cement seized by the security services increased from 6.7 tons in 2011 to 26.35 tons in 2012 and to more than 200 tons in 2013. In Mali, quantities are imported on an irregular basis, according to the growth of orders, but seem to remain modest. In Kidal, the price of a 50-kilogram bag is CFAF 6,500, or CFAF 2.6 million for the quantity required to fill a 20-ton truck. This trade probably accompanies the process of Sahelian urbanization. This is particularly true for the Niger-Nigeria-Benin borders (Walther, Tenikue, and Kuepié 2012).

Cigarette smuggling in decline

Cigarette smuggling is a typical example of the adaptation of cross-border fraud to economic developments. It was an important fraud movement in the 1990s to Algeria, but since then cigarette smuggling has dramatically declined since 2005 and the manufacturing of foreign brands (under license) by STAEM.³⁰ Entering Africa through the port of Cotonou in Benin, cigarettes were driven by truck to the border towns of Assamakka in Niger and Boughassa in Mali, where they were legally sold and then transported into Algerian territory via light four-wheel-drive-type vehicles. The merchandise was then conveyed to Ouargla, which was the point of distribution across the territory. Routes of cigarette smuggling followed a defined path: Boughassa, Bordj Badji Mokhtar, Moulay Lahcen, Amguid, and then the same corridor: Faidjat and then Bordj Omar Idris and Ouargla.

Cigarette smuggling was structured traffic, in particular controlled by the traders of the Ouargla region who ensured its distribution to the *wilayas* in northern Algeria. Touareg populations were recruited as drivers or scouts because of their knowledge of the field (they charged by the operation

²⁸ The currently authorized quantities for Tinzawaten are one convoy per month and three tanks of gasoline and six of diesel for four petrol stations.

²⁹ The term *convoy* is used by both smugglers and customs to designate an operation of fraudulent routing of products to import or export.

³⁰ Provisions of the Finance Act of 2001 opened the tobacco market to foreign investors. STAEM, an Emirati consortium of Arab investors, was approved by the Ministry of Finance as a manufacturer of tobacco. This company, a joint venture established in 2002 with the National Society of Tobacco and Matches (SNTA), holds 49 percent of the shares. STAEM is officially authorized to import and distribute, during an intermediate phase, branded cigarettes to be manufactured locally. The increase in the local production has affected cigarette smuggling.

DA 80,000 (about \$1,000) for the driver, DA 10,000–15,000 for the “graisseur,”³¹ and DA 70,000 for the scout, or about \$2,000 in total.

This smuggling has gradually lost its economic appeal in Algeria since the opening of plants under license. In 1999 a vehicle carrying 60 cartons of cigarettes could make between DA 700,000 and DA 800,000 (\$10,000) in net profit. In 2004 profits decreased to DA 600,000 (\$7,500) per vehicle. In recent years, payments have been made on loan and are often unpaid because of the declining demand for this product. The gradual decrease in profits has led smugglers to abandon this type of traffic. The statistics on seizures of cigarettes from 2011 to 2013 (it amounted to just a few hundred dollars in 2013) indicate the gradual disappearance of this pattern of fraud, but the situation also might be related to the insecurity situation prevailing since 2012.

Meanwhile, the market for Marlboro cigarettes may have lessened because of the distribution of the brand by STAEM, but that for the Greek-made American Legend cigarettes has not. Trade sources estimate the smuggling volume from Mali to Algeria at nearly 9,000 cartons a week. The main country of origin is Burkina Faso. The earned profits in Mali, particularly in the region of Gao, are CFAF 200 per pack or CFAF 18 million (\$37,500) per truck and a few million dollars per year.

Malian exports of bazin fabric

Bazin fabric is a valued commodity in Algeria, particularly in the south among the Malian and Nigerien communities established in Tamanrasset and Adrar. Raw fabric is usually imported from Germany and is then sewed and manufactured in Mali, where expertise has been developed. Bazin fabric is mainly exported from Mali to Algeria and is an extremely profitable sector. However, it is difficult to estimate how much of this fabric is exported because of the weak structure of the sector, which relies largely on individual entrepreneurs.

Transport is usually by car, with each car carrying 5–6 packages of 125 bazins on average, or 690 *boubous* (robes) per car. Second-quality bazin is sold for CFAF 36,000 per piece in Bamako (up to CFAF 80,000 per piece for Yara bazins), and about DA 20,000 per piece (or more than CFAF 120,000 per piece) in Tamanrasset. Each bazin represents a profit of CFAF 87,000 (\$180) or a profit per car of CFAF 60 million (\$125,000) for a turnover of CFAF 83 million (\$173,000) or a profit rate of 72 percent, from which the transport cost must be deducted. No customs duty applies to the exports from Mali. However, because of the prevailing insecurity in northern Mali, cargoes are divided into several cars or are sent through Niger via transport companies. Although it is difficult to estimate the volumes exported to Algeria, it is thought that five carloads of the value just described are shipped each week for a weekly turnover of CFAF 415 million (about \$860,000), totaling several tens of millions of dollars each year.

Malian exports of livestock

Livestock is the main good exported (smuggled) by Mali to Algeria, and overall represents the third largest export revenue for Mali after gold and cotton. However, livestock exports are mainly intended for West Africa. The three northern regions are home to 20 percent of the Malian herd of

³¹ Person who takes care of vehicle maintenance during a journey. The mechanic is essential for older models of 4x4 vehicles.

bovines (1.8 million head), 48 percent of the herd of small ruminants (11.3 million sheep and 15.7 million of goats), as well as herds of camels.

Trucks transporting livestock to Mali usually return to Algeria loaded with cattle. Traders gather livestock in the camps they pass on the way back to the Algerian border, especially in the regions of Gao and Kidal (the Timbuktu region has a smaller herd). Certain periods, starting with the weeks before Tabaski (religious holiday), are advantageous for the export of livestock because they are peaks of consumption. The exported livestock are mainly sheep, as well as camels and bovines. Trade sources estimate that 50 percent of the trucks from Algeria are backloaded with cattle, not always full, which makes it difficult to quantify the volume. The majority of these flows is not recorded by Malian customs.

In spite of these limits, it is possible to estimate the volumes in 2011. On a weekly basis, 90 trucks were loaded with cattle. An average load consisted of about 40 cattle, with an average price of CFAF 150,000 (minus CFAF 8,000 for transport costs). On this basis, the turnover per truck could be estimated at CFAF 5.7 million (over \$11,000) or over CFAF 510 million weekly for northern Mali (or over \$1 million).

The social and governance impact of informal trade

This section presents the social and governance impact of informal trade mainly in terms of job creation, local governance, and on purchasing power and poverty reduction.

Social impact

The social impact of informal trade is massive in northern Mali since it is a major economic activity and contributes to poverty reduction. This has been the case for decades. However, with the drastic decrease of informal trade, poverty is expected to rise in the northern part of Mali.

Impact of informal trade on employment, purchasing power, and regional gross domestic product

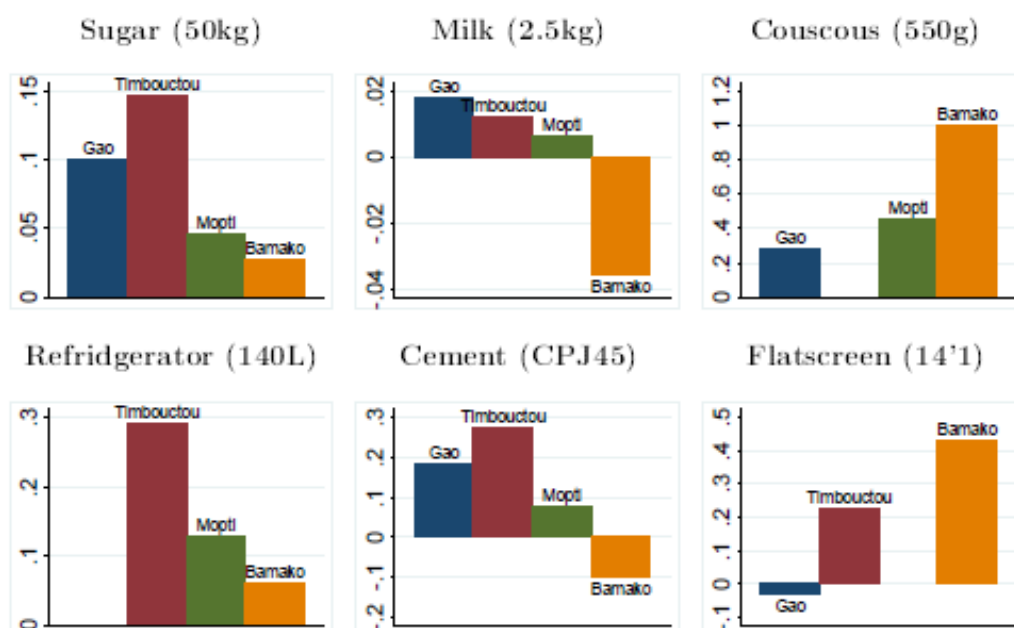
In terms of job creation, 1,500 traders in food products are operating in Tamanrasset and more than 900 in Adrar (Adrar's population is nearly 400,000). In southern Algeria, no more than 100 traders are smuggling fuel to Mali (and to Niger) because this sector is much riskier now that Algerian authorities are focusing on fuel smuggling. Therefore, it is an economic activity in Algeria intended for a minority, which is perhaps explained by the incurred risk.

Mali directly benefits from subsidy policies established by the Algerian authorities for certain products. This explains in part the access of the residents of northern Mali to products that cost less than those in Bamako. Kidal benefits even more because its prices are quite similar to those found in Algeria. In terms of fuel, customs clearance of fuel is authorized only in Bamako, which allows the region up to Douentza to benefit from Algerian fuel prices.

Kidal is largely economically integrated with Algeria through smuggling. Figure 2 compares the prices of sugar, milk, couscous, refrigerators, flat screen TVs, and cement in four Malian cities to those in Kidal. Except for the prices of cement and milk in Bamako, Kidal is the least expensive city for all products. Apart from flat screen TVs, Gao and Timbuktu are often more expensive than Bamako and

Mopti, which can be explained by the transport costs in relation to the Algerian border (or in relation to Bamako).

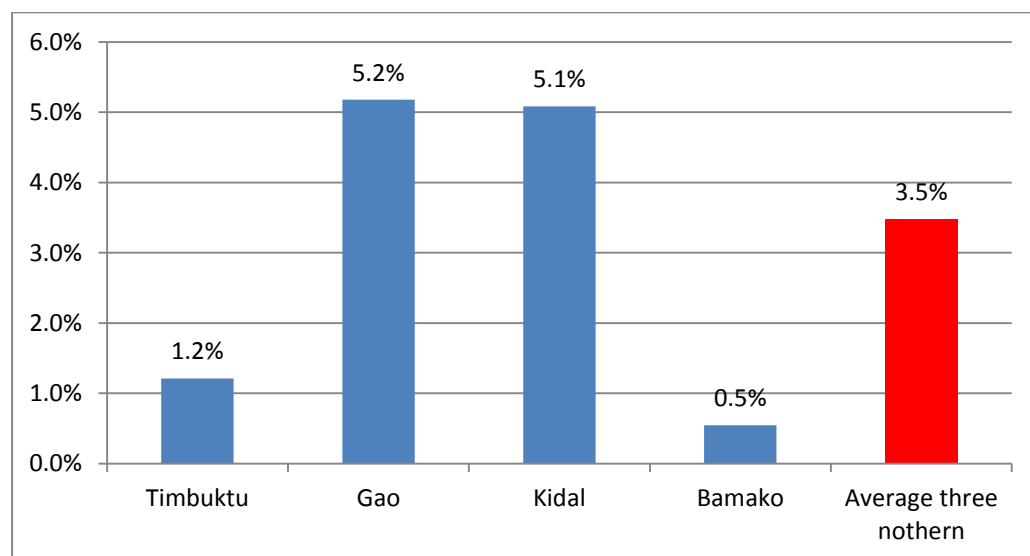
Figure 2 Price Comparison of Six Goods: Gao, Timbuktu, Mopti, and Bamako with Kidal



Source: National Statistical Institute of Mali.

Both Kidal (and Gao) appear to largely benefit from informal trade and is most probably one of the most or even the most important economic activity in Kidal region. Using the margins of informal trade per city, one can calculate a proxy of value added to the regional gross domestic product (GDP). In 2011 this ratio was about 5 percent for Kidal and Gao and about 1 percent for Bamako and Timbuktu (figure 3).

Figure 3 Percentage of Value Added to Regional GDP (Mali) from Informal Trade: Timbuktu, Gao, Kidal, and Bamako, 2011



Source: Data on GDP (2001–09 average) and surveys for the amounts of informal trade for the region: National Statistical Institute of Mali.

Estimating the trade margins

How much profit is generated locally by informal trade?³² To estimate the margins, one needs to know the volumes traded for each of the routes (the number of trucks and the average tonnage per truck), the price of each product in each city, and, to estimate the volume traded for each product, the cost of transport and the tariffs paid.

Several conclusions can be drawn in light of data collected for 2011:

- All of the goods traded in northern Mali (transit or final destination) generated a weekly margin of CFAF 603,100,000 (approx. \$1.2 million), with an average margin of 31 percent.
- The margin rate is higher when the goods are intended for Bamako (43 percent), Niger (30 percent), or West Africa. This explains why traders value northern Mali as a transit area.
- For intra-northeast Mali exchanges, Timbuktu (32.1 percent) and Gao (25.17 percent) turn out to be more profitable than Kidal (15.5 percent), which probably explains the role played by traders in Kidal in the distribution in Mali and the lower purchasing power in Kidal.

According to traders and transporters, the average transport costs from Bordj Badji Mokhtar are CFAF 27,000 (\$56) per ton for Kidal, CFAF 41,000 (\$85) per ton for Gao, CFAF 54,000 (\$112) per ton for Timbuktu, CFAF 90,000 (\$187) per ton for Bamako, and CFAF 100,000 (\$208) per ton for Tahoua and Agadez.

Using the cost (per ton) for each of the main products traded, it is possible to quantify the earned margins by sector for each city (see table 6).

³² For more details, see annex E.

Table 6 Weekly Net Margin Rate Per City and Per Product: Selected Cities in Mali and Niger, 2011

CFAF millions

Product	Kidal (Mali)		Gao (Mali)		Timbuktu (Mali)		Bamako (Mali)		Tahoua and Agadez (Niger)		Total per product	
	Net margin	Turnover	Net margin	Turn over	Net margin	Turnover	Net margin	Turnover	Net margin	Turnover	Net margin	Turnover
Flour	4.33 (17.6%)	24.61	11.6 (21.2%)	54,6	4.28 (33.4%)	12.8	51.5 (53.6%)	96	70.5/25.5 (45%)	213	167.71 (42%)	401.1
Pasta	9.17 (18.7%)	49	22.87 (32%)	71.4	4.71 (35%)	13.5	23.25 (41.5%)	56	81.6 (27.7%)	294.4	141.6 (29%)	484.3
Wheat semolina	2.63 (9.6%)	27.2	10.1 (23.5%)	43	3.28 (34.2%)	9.6	11 (44.9%)	24,5	13.2 (16.7%)	79.2	40.21 (22%)	183.5
Diesel	5.43 (15.2%)	35.75	7.2 (24%)	30	4.78 (34%)	14	Mopti 11.95 (34.1%)	35	9 (25%)	36	50.54 (34%)	150.75
Gasoline	12.18 (23.2%)	52.5										
Sugar	0.47 (4.5%)	10.5	4.17 (15%)	28					9.6 (22%)	43.2	14.24 (17.4%)	81.7
Milk	1.49 (9.4%)	15.83	22.88 (30%)	76			29.1 (38.8%)	75			53.47 (32%)	166.83
Dates			9.8 (33.6%)	29.16			60 (42.9%)	140	40.8 (24%)	170	110.6 (33%)	339.16
Appliances	0.2 (10.5%)	1.9	1.4 (20.3%)	6.9	2.8 (33%)	8.4	12.3 (52.3%)	23.52			16.7 (41%)	40.72
Other products	0.6 (3.4%)	17.6	1.35 (5.6%)	24	2.39 (21.7%)	11	3.6 (20%)	18			7.94 (11.2%)	70.6
Total per region	36.5 (15.5%)	234.89	91.37 (25.17%)	363.0 6	22.24 (32.1%)	69.3	202.7 (43%)	468	250.2 (30%)	83.8	Total margin: 603.1 (31.4%)	

Source: authors' computations based on interviews.

In 2014 the rate margins have fallen in the north (22 percent), but have been halved for the south of Mali and Niger (19 percent). The weekly margins in 2014 account for CFAF 134.703 million, for a margin of 20.5 percent against 29 percent in 2011. An overall decrease of 78 percent in margins was observed in 2014 compared with the margins in 2011 (CFAF 603.1 million), or more than \$18 million annually and demonstrates that income generation is going down dramatically in the northern part of Mali.

Therefore, informal trade has been crucial for income generation and poverty reduction in North Mali. The main problem is that the governance impact of informal trade is not as positive and may even lead to some security issues.

Impact on governance

The negative impact of informal trade on governance is important. And yet it is difficult to identify a causal link between smuggling and weak institutions because the two go hand in hand: smuggling is possible because the controlling institutions are weak, but smuggling also helps to keep them weak to the extent that a collusive system is established.

Governance issues in Algeria

The first (sensitive) question to be asked is how can informal trade continue to grow when confronted with the massive presence of the agents of the Algerian state.

About 30 economic operators (all of Algerian nationality) are authorized annually to operate barter trade. A review of the lists of the last three years reveals that they have not changed significantly despite the changes, over the same period, of officials at the *wilaya* level and in the direction of trade and customs. This confirms that, except in cases of fraud duly recorded, the administrative authorities do not undertake real monitoring of licenses. The trading system is largely set up and controlled by local populations.

A review of the lists also reveals that in the trade in widely consumed products, some tribes such as the Touadj³³ are overrepresented among the licensed operators in barter trade. The export of dates through barter trade also enables operators to circumvent the strict foreign exchange regulation in Algeria. According to interviews, margins from date exports are converted at the currency exchange offices in Niger and then transferred either by Western Union or by *hawala* system to Dubai, thereby fueling the international informal trade. This system is especially used in informal trade operations with importers in northern and eastern Algeria.

Despite the system set up by Algeria, the fight against fraud continues to lag: for example, 6,312 smuggling cases were discovered in 2011 on the Algerian territory, but only 3 percent were at Tamanrasset and 8 percent over the three southern regions (Tamanrasset, Illizi, and Bechar). The value of goods seized in the Tamanrasset region accounted for 4.34 percent of the total value of seizures at the national level.³⁴

³³ This is a tribe called by Tuareg Dag Taoudji.

³⁴ As opposed to 15.3 percent at the regional customs in Tlemcen (on the border with Morocco) and nearly 11 percent for the regional customs in Tébessa (Border Zone East).

Because of the importance of bribes and collusion in controlling agencies, especially at borders, there is a potential risk of smuggling of illicit goods, such as weapons, which may have a conflict impact. Some drug traffickers seek to diversify their activities using smuggling routes of staples as a screen or financing new traders with money derived from drugs or retailers as a loan.

However, based on interviews and confirmed by Lacher (2013), it is important to distinguish between smugglers and drug traffickers/terrorists. It seems that a minority of smugglers started to trade illicit goods and that is why, a fully repressive policy could alienate the majority of traders, who continue to trade subsidized goods.

Links with the weak governance in northern Mali

Since the mid-2000s, efforts have been made to reaffirm the customs presence in northern Mali, in particular in Timbuktu. Before the crisis of 2012, a customs station operated in In Khalil, where it collected tariffs and duties. Customs agreed on a fixed price according to the goods transported, but it was more or less symbolic for each truck entering Mali on the condition that the truck not continue its journey south. If it did not comply, duties increased and the driver of the truck had to make an import declaration.³⁵ This factor explains the weakness of the official import data because to a great extent, imports from Algeria to the north were not reported.

According to several customs sources in Mali, 60 percent of the flows escape customs control. Quantities reported to the customs are generally 40–50 percent less than the actual flows. Moreover, trucks are usually overloaded by 20–30 percent. Thus goods are declared for about 20 percent of their actual value. On average, customs offices in the north have been collecting about \$1–1.5 million, which means that the goods were probably cleared for about 5–10 percent of their value (for an average tariff rate of 20–25 percent).³⁶

Today the situation seems to have deteriorated even more since only a few tens of thousands of dollars are collected at the border (less than 1 percent of the value), and there are no longer any customs offices in northern Mali, largely because of the rebellion in January 2012. Malian customs officials struggle to win against smuggling actors who are increasingly more organized and who have little difficulty in rendering customs offices inoperative. Customs offices are slowly reestablishing themselves in Timbuktu and Gao, but there are only a few agents in these two cities, and they are unable to travel in the region. In Kidal, there is no custom presence.

Mali has some similarities with Algeria because trader networks in Mali control the main trade sectors. It is not uncommon for mayors, deputies, or presidents of the regional chambers of

³⁵ For a 10-ton truck coming from Bordj Badji Mokhtar, paid duties in 2014 were about CFAF 75,000 (\$156) in Kidal, CFAF 120,000 (\$250) in Gao, CFAF 140,000 (\$290) in Timbuktu, and CFAF 400,000 (\$830) in Bamako, as in northern Niger. These figures are averages, knowing that many traders are paying duties sometimes more modest because of the corruption within customs, or even sometimes are fully exempt from customs duties by circumventing customs offices.

³⁶ According to the West African Economic and Monetary Union (UEMOA), customs duties at the Malian border (in percentage of the value of goods) are 20 percent for dates, couscous, pasta, and cigarettes and 10 percent for gasoline (for ordinary car) and car tires.

commerce, or their counterparts, to be involved in these sectors.³⁷ It is therefore good for trade in northern Mali but erodes the legitimacy of these representatives elected by the population.

Some of this “new” elite invest in communities and reinforce their legitimacy, which creates even more resentment from the representatives of the Malian state. Due to their well-known source of income, political and state institutions, such as mayors, customs, army do not necessarily appear to be legitimate but may also become “role model”, especially for the youth.

It also explains why repression of informal trade is all the more difficult because trader networks, which control flows, are decentralized (Walther 2014). Also, when a cargo is halted or a trader is neutralized, it is possible for another member of the network to replace the trader and to continue the traffic.

Conclusions and recommendations

In the Sahel as in other parts of the world, borders are a fertile ground for informal trade, especially in a desert area. Walther (2009) refers to a “mobile space”—that is, circulation is the most appropriate method of managing uncertainty for the Sahelian life.

For Algeria

Three main policies explain the current flows from Algeria to Mali: 1. Subsidies policy, 2. Barter trade and closure of the border, 3. Governance of border controlling agencies. These policies are interlinked and would require to be tackled concomitantly if there would be willingness to reduce smuggling.

With this end in view (which could have some political implications in the south of the country),

- Algeria should revise its regulations on barter trade with Mali because this policy seems to benefit a very small number of actors, and it has not countered smuggling. Furthermore, given its very restrictive nature, it creates incentives for corruption of those institutions in the south of the country responsible for control such as customs or the army.
- In addition, the subsidy policy in place for the south should be reviewed because the compensation fund for transport and the generous subsidies for flour and fuel encourage smuggling. We estimate that the minimum cost of the loss for the Algerian state was about \$45 million in 2011 and less than \$10 million now.³⁸ Moreover, better targeting the poorest population would be important to reduce the incentive for smuggling.

Finally, because of the potential security impact of smuggling, it is important to re-engage the dialogue with Mali (it appears that official bilateral meetings take place only every three years).

³⁷ Walther (2009) showed that traders were heavily represented in the National Assembly of Niger.

³⁸ Most of this cost comes from the subsidy of gasoline. Forty-two million liters are subsidized to about \$1 per liter, whereas subsidies are at very low levels for milk.

For Mali

A fully repressive policy against smuggling does not appear to be possible since customs seem to be mostly circumvented along the Algerian border and probably does not have the possibility to implement a repressive policy. Moreover, such a policy would have a negative impact on the well-being of northern populations.

However, a laissez-faire policy is also not an option because the margins of this trade allow smugglers to render the institutions (customs, military and political authorities) in northern Mali inefficient and collusive. At the same time, some sort of control is important – primarily to avoid further instability and violence if weapons and drug could enter the Malian territory.

Instead of having controls at borders with customs border-posts, controls should probably be less carried out with a revenue angle but with a focus on increasing security. Mali has incurred a low revenue loss from smuggling. Moreover, based on an average rate of 20 percent of the value of goods (a higher rate than the reality), the potential revenue would be about \$6 million now (versus less than \$20 million in 2011). In addition, the volume of informal imports represented less than 3 percent of total imports (official) of Mali in 2011.

The control framework should rely on intelligence sources in cities/market cities instead of being focused at borders. For centuries, in desert regions, controls have been taken place in cities where goods are traded and not in the desert where roads can be created/recreated anywhere (as seen on satellite pictures). Therefore, the “traditional” way of controlling the border is ineffective in this area.

Finally, it will important to initiate joint discussions with Algeria to find an adequate cross-country solution, especially for the most sensitive trafficking (drugs and weapons).

Annex A

Short Presentation on the Method of Mirror Statistics

The following analysis is based on the work of Fisman and Wei (2009), Jean and Mitaritonna (2010), Nitsch (2012), and Raballand et al. (2013) on the approach to informal trade through official trade data.³⁹ They propose using the difference between the measurements reported by the authorities of the importing and exporting countries for the same trade flow in order to obtain an initial assessment of informal trade (the so-called method of mirror statistics). In principle, there is a minimum difference between the reported values on both sides of a border because exports are valued f.o.b. (i.e., without freight and insurance), and imports are valued c.i.f. (i.e., shipping and insurance costs are included). The difference can be amplified by classification errors, problems of time, exchange rates, etc.⁴⁰ However, Bhagwati (1967) noted that over 30 percent of the difference between reported imports and exports, “classic” explanations are no longer satisfactory. Beyond this threshold, presumption of undervaluation or overvaluation of imports or exports would be preferred.

The difference is calculated on the following basis for a given year and a given pair of countries:

$$\%Gap_{ijt}^k = (Imports_{ijt}^k - Exports_{jit}^k) / Imports_{ijt}^k$$

K corresponds here to a category of goods defined at level 6 of the Harmonized System (HS) classification, Revision 2.

³⁹ This approach is old and dates from the late 1960s with Bhagwati (1967), but it is now experiencing a revival.

⁴⁰ For a discussion of potential explanations, see Raballand, Cantens, and Arenas (2013).

Annex B

Goods Recorded on Both Sides of the Border: Algeria to Mali, 2007–12

Year	Exchange products	Declared value at import (US\$)	Declared value at export (US\$)	Ratio between declared value at import and export
2007	Perfumes and toilet waters	87	83	1.05
2007	Electrical appliances for switching	10,865	4,896	2.22
2007	New pneumatic tires of rubber	224,199	64,773	3.46
2007	Electrical switches for a voltage not exceeding 1,000 V, n.e.s.	22,305	5,237	4.26
2007	Needles, catheters, cannulae. and the like, n.e.s.	23,859	46,642	0.51
2007	Sodium hydrogencarbonate (sodium bicarbonate)	1,578	6,053	0.26
2008	New pneumatic tires of rubber	256,727	109,014	2.35
2008	Inner tubes of rubber, n.e.s.	5,068	274	18.50
2008	Other perfumery, cosmetic or toilet preparation	568	1220	0.47
2008	Soap and organic surface-active products in bar	94	3,330	0.03
2010	Sanitary towels and tampons, napkins and napkin	91,782	96,022	0.96
2010	Filtering or purifying machinery and apparatus	62,936	68,040	0.92
2010	Electrical switches for a voltage not exceeding 1,000 V, n.e.s.	7,911	6,493	1.22
2010	Other jams, fruit jellies, marmalades, etc.,	223	129	1.73
2010	Needles, catheters, cannulae, and the like, n.e.s.	13,503	19,390	0.70
2010	Electrical plugs and sockets for a voltage not exceeding 1,000 V	5,794	9,629	0.60
2010	Sodium hydrogencarbonate (sodium bicarbonate)	83,574	10,918	7.65
2010	Perfumes and toilet waters	1197	44	27.20
2011	Perfumes and toilet waters	29	29	1.00
2011	Instruments and appliances used for medical purpose	135,414	157,758	0.86
2011	Citric acid	18,994	2,819	6.74
2011	Dates, fresh or dried	947,290	107,840	8.78
2011	Sanitary towels and tampons, napkins and napkin	84,175	3,495	24.08
2011	Salt and pure sodium chloride; sea water	1,913	4,961	0.39
2011	Sodium hydrogencarbonate (sodium bicarbonate)	19,471	53,345	0.37
2011	Trade advertising material, commercial catalogues	68	263	0.26
2011	Bentonite	1,162	11,188	0.10
2011	Tubular metal needles and needles for sutures	1,426	16,297	0.09
2011	Mineral waters and aerated waters, unsweetened	275	33,327	0.01
2011	Filtering or purifying machinery and apparatus	398	350,764	0.00
2012	Vinegar and substitutes for vinegar obtained	160	160	1.00
2012	Surgical gloves	333	349	0.95
2012	Syringes, with or without needles	244	264	0.92
2012	Eye makeup preparations	118	107	1.10
2012	Freezers of the upright type	6,734	4,859	1.39

2012	Other jams, fruit jellies, marmalades, etc,	997	1,559	0.64
2012	Sanitary towels and tampons, napkins and napkin	74,338	31,932	2.33
2012	Soap and organic surface-active products in bar	882	278	3.17
2012	Sodium hydrogencarbonate (sodium bicarbonate)	26,487	46,570	0.57
2012	Garments of cotton, knitted or crocheted, n.e.s.	1,287	25	51.48
2012	Uncooked pasta, not containing eggs, not stuffed	43181	760	56.82
2012	Couscous	2292,77	1,901	120.61
2012	Beauty, makeup, skin-care (including suntan), n.e.s.	723	1,602	0.45
2012	Vegetable products, n.e.s.	132	357	0.37
2012	Unfrozen orange juice, unfermented	1,216	4,771	0.25
2012	Perfumes and toilet waters	84	345	0.24
2012	Manicure or pedicure preparations	86	480	0.18
2012	Trade advertising material, commercial catalogues	89	596	0.15
2012	Tubular metal needles and needles for sutures	1,906	15,732	0.12
2012	Shampoos	51	688	0.07

Data source: UN COMTRADE.

Note: n.e.s. = not elsewhere specified.

Annex C

Imports of Cigarettes and Gasoline, Mali

Year	Exporting country	Tonnage (kg)	Value (USD)	Ratio to total tonnage	Ratio to total value
Cigarettes					
2007	Benin	361,800	6,705,806	37%	29%
2007	South Africa	609,790	16,045,517	62%	70%
2007	<i>Total</i>	<i>978,010</i>	<i>22,870,699</i>		
2008	Benin	249,000	4,995,733	24%	17%
2008	South Africa	796,173	24,020,439	76%	83%
2008	<i>Total</i>	<i>1,046,898</i>	<i>29,091,779</i>		
2010	Benin	20,837	386,080	1%	1%
2010	Senegal	13,444	491,939	1%	2%
2010	South Africa	1,401,702	31,660,008	97%	97%
2010	Switzerland	12,436	192,432	1%	1%
2010	<i>Total</i>	<i>1,449,631</i>	<i>3,275,6290</i>		
2011	Senegal	10,704	337,013	0%	1%
2011	South Africa	2,236,744	43,060,097	100%	99%
2011	<i>Total</i>	<i>2,247,588</i>	<i>43,397,619</i>		
2012	Senegal	386,779	6,460,212	17%	17%
2012	South Africa	1,923,189	31,573,934	83%	83%
2012	<i>Total</i>	<i>2,309,983</i>	<i>38,034,177</i>		
Gasoline					
2007	Benin	116,268,585	89,338,418	18%	19%
2007	Burkina Faso	18,943,967	7,375,192	3%	2%
2007	Côte d'Ivoire	143,423,978	101,716,372	22%	22%
2007	Ghana	51,423,696	37,953,627	8%	8%
2007	Senegal	231,040,500	166,509,945	36%	35%
2007	Togo	80,763,536	6,285,0512	12%	13%
2007	<i>Total</i>	<i>648,122,454</i>	<i>470,243,298</i>		
2008	Benin	131,710,362	68,370,980	20%	10%
2008	Côte d'Ivoire	130,920,524	147,560,768	20%	21%
2008	Ghana	61,830,224	37,056,767	10%	5%
2008	Senegal	248,145,957	405,520,714	38%	58%
2008	Togo	67,593,994	28,665,569	10%	4%
2008	<i>Total</i>	<i>650,688,664</i>	<i>697,416,591</i>		
2010	Benin	653,978,987	467,106,697	41%	39%
2010	Côte d'Ivoire	245,049,731	172,518,793	16%	14%
2010	Ghana	72,389,063	50,293,048	5%	4%
2010	Senegal	467,384,158	399,858,285	30%	33%
2010	Togo	120,187,706	95,054,371	8%	8%
2010	<i>Total</i>	<i>1,578,913,017</i>	<i>1,201,245,939</i>		
2011	Benin	222,780,997	253,799,430	25%	26%
2011	Côte d'Ivoire	128,113,517	145,604,076	14%	15%
2011	Ghana	75,705,792	86,354,302	8%	9%
2011	Senegal	417,733,154	428,311,413	47%	45%
2011	Togo	31,625,163	29,241,745	4%	3%
2011	<i>Total</i>	<i>8,9351,4399</i>	<i>961,107,209</i>		
2012	Benin	151,333,000	172,068,033	17%	18%
2012	Burkina Faso	15,868,320	18,621,642	2%	2%
2012	Côte d'Ivoire	114,477,971	129,099,918	13%	13%
2012	Gambia, The	17,171,000	10,399,719	2%	1%
2012	Ghana	62,415,167	69,525,921	7%	7%
2012	Niger	8,8769,000	99,288,612	10%	10%

2012	Senegal	433,966,422	447,072,157	48%	46%
2012	Total	899,870,517	963,333,739		

Data source: UN COMTRADE.

Annex D

Algorithm Used to Identify Roads on Satellite Images

The algorithm used can be summarized as follows:

- Smooth image to reduce pixel size to 75 centimeters, judged as optimal.
- Apply Gaussian pyramid to reduce processing time
- Apply anisotropic gradient to smooth image but keep irregular edges.
- Apply Sobel filter to sharpen image edges (first-degree derivative).
- Apply anisotropic gradient again.
- Thresholding: Set to 0 all pixels with values below mean.
- Apply adaptive threshold method.
- Remove all objects (= block contiguous white pixels) below 100-pixel size.
- Compute eccentricity of bounding ellipse for all objects and keep only objects with eccentricity greater than 0.7 (to identify objects that are elongated—that is, road segments).
- Skeletonize image to keep only the trace.
- Apply a Hough line transform to find lines (applied several times with different parameter values).
- Keep only sets of lines that are parallel and close (distance interval is width of a truck).

Annex E

Calculating Margins for Flour and Pasta in Various Cities

Flour

A 10-ton truck connecting Bordj Badji Mokhtar to Kidal earns a margin of CFAF 750,000 (CFAF 600,000 + 25 percent overload) from which is deducted a transport cost of CFAF 270,000 and about CFAF 75,000 in customs duties, for a net margin of CFAF 405,000. The weekly margin is therefore CFAF 4.333 million with an annual turnover of CFAF 24.61 million (18 percent margin).

A 10-ton truck connecting Bordj Badji Mokhtar to Gao earns of CFAF 1.125 million (CFAF 900,000 + 25 percent overload) from which is deducted a transport cost of CFAF 410,000 and about CFAF 120,000 in customs duties, for a net margin of CFAF 595,000. The weekly margin is therefore CFAF 11.602 million for a turnover of CFAF 54.65 million (21.2 percent margin).

A 10-ton truck connecting Bordj Badji Mokhtar to Timbuktu earns a margin of CFAF 1.750 million (CFAF 1.4 million + 25 percent overload) from which is deducted a transport cost of CFAF 540,000 and about CFAF 140,000 in customs duties, for a net margin of CFAF 1.070 million. The weekly margin is therefore CFAF 4.28 million for a turnover of CFAF 12.8 million (33 percent margin)

A 10-ton truck connecting Bordj Badji Mokhtar to Bamako (after unloading in Douentza or Gao) earns a margin of CFAF 3.875 million (CFAF 3.1 million + 25 percent overload) from which is deducted a transport cost of CFAF 900,000 and CFAF 400,000 in customs duties, for a net margin of CFAF 2.575 million. The weekly margin is therefore CFAF 51.5 million for a turnover of CFAF 96 million (53 percent margin).

A 10-ton truck connecting Bordj Badji Mokhtar to Niamey (via Gao) earns a profit of CFAF 3.75 million (CFAF 3 million + 25% surcharge) from which is deducted a transport cost of CFAF 1 million and about CFAF 400,000 in customs duties, for a net margin of CFAF 2.35 million. The weekly margin is therefore CFAF 70.5 million. Across the Niger, the weekly margin is therefore CFAF 96 million and the annual turnover is CFAF 213 million (45 percent margin).

Pasta

A 10-ton truck connecting Bordj Badji Mokhtar to Kidal earns a margin of CFAF 1 million (CFAF 800,000 + 25 percent overload) from which is deducted a transport cost of CFAF 270,000 and CFAF 75,000 in customs duties. The weekly margin is therefore CFAF 9.17 million for a turnover of CFAF 49 million (19 percent margin).

A 10-ton truck connecting Bordj Badji Mokhtar to Gao earns a margin of CFAF 1.875 million (CFAF 1.5 million + 25 percent overload) from which is deducted a transport cost of CFAF 410,000 and CFAF 120,000 in customs duties, for a net margin of CFAF 1.345 million. The weekly margin is therefore CFAF 22.865 million for a turnover of CFAF 71.4 million (32 percent margin).

A 10-ton truck connecting Bordj Badji Mokhtar to Timbuktu earns a margin of CFAF 2.25 million (CFAF 1.8 million + 25 percent overload) from which is deducted a transport cost of CFAF 540,000

and CFAF 140,000 in customs duties, for a net margin of CFAF 1.57 million. The weekly margin is therefore CFAF 4.71 million for a turnover of CFAF 13.5 million (35 percent margin).

A 10-ton truck connecting Bordj Badji Mokhtar to Bamako earns a margin of CFAF 3.625 million (CFAF 2.9 million + 25 percent overload) from which is deducted a transport cost of CFAF 900,000 and CFAF 400,000 in customs duties, for a net margin of CFAF 2.325 million. The weekly margin is therefore CFAF 23.25 million for a turnover of CFAF 56 million (42 percent margin).

A 10-ton truck connecting Bordj Badji Mokhtar to Taouha or Agadez (via In Khalil) earns a margin of CFAF 2.375 million (CFAF 1.9 million + 25 percent overload) from which is deducted a transport cost of CFAF 700,000 and CFAF 400,000 in customs duties, for a net margin of CFAF 1.275 million. The weekly margin is therefore CFAF 81.6 million for a turnover of CFAF 294.4 million (28 percent margin).

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