Import vulnerability in the Middle East: effects of the Arab spring on Egyptian wheat trade

Willeke Veninga¹ · Rico Ihle¹

Received: 27 September 2016 / Accepted: 13 December 2017 / Published online: 5 February 2018
© The Author(s) 2018. This article is an open access publication

Abstract

The ‘Arab Spring’ spilled over to Egypt from neighbouring Arab countries in the first half of 2011. General chaos during the political instabilities suddenly caused high uncertainty for consumers and traders, and temporarily rendered institutions dysfunctional. This eventually might have led to a negative market shock, impeding economic activity in general and, in particular, trade. Wheat is the main ingredient in the Egyptian diet and is heavily subsidised in the country. The general availability of cheap wheat flour creates a very high domestic demand for wheat. Therefore, Egypt is highly dependent on wheat imports from other countries for ensuring food security. This dependency makes the country vulnerable to increasing food prices and other shocks to the world market which might challenge flows of imports. This paper investigates the effects of domestic political instability on the wheat trade in Egypt. We analysed monthly trade data for wheat from the Comtrade Database of the United Nations, particularly imports and exports of wheat and wheat flour in Egypt from 2010 to 2014. The analysis showed pronounced and stable seasonal patterns whereby the pattern of 2011, the year of most intensive political turmoil in Egypt, was found to differ significantly from other years. We found robust evidence for a strong, negative demand shock in the second half of 2011 caused by the substantial and enduring political instabilities in the country which resulted from the Arab Spring.

Keywords Arab spring · Food insecurity · Mena · Trade shock · Violent conflict · Wheat

1 Introduction

Wheat plays an important role in the Egyptian national diet. It is one of the primary food sources in Egypt, next to maize and rice (FAO 2014). Egyptians get more than one-third of their daily calories and 45% of their daily protein from wheat, mainly in the form of bread (IFPRI 2000). Wheat is a major domestically-produced as well as traded food crop in Egypt. However, Egyptian wheat production is far from sufficient to satisfy the domestic demand for wheat. The most limiting factors for wheat production in Egypt are arable land and capital, and to a lesser extent, water and labour (Wichelns 2001). Its population was estimated to be 92 million people

(World Bank 2016a). The country continues to have a high population growth rate of 2.7% annually (World Bank 2016b), so that it grows by about 2 million persons per year, which represents a large, sustained demand-driving factor. Additionally, Egypt is the most populated country of the Middle East and North Africa (MENA) region. Therefore, 45–55% of the wheat consumed has to be imported, which makes Egypt the world’s largest wheat importer (FAO 2014; Woertz and Keulertz 2015). The dependence on wheat imports makes Egypt vulnerable to increasing food prices or other market shocks to the world market which might impede its import needs.

Egypt is classified as a middle income country, but it still faces development challenges due to regional inequalities. The country can be divided into two parts: Lower Egypt and Upper Egypt, representing the North and the South, respectively. In Lower Egypt, the river Nile stretches out while Upper Egypt consists of mainly rural areas and desert. Upper Egypt is ranked lower socio-economically than the country average. Therefore, in these areas the World Food Programme provides assistance to improve food security,

✉ Rico Ihle
rico.ihle@wur.nl

¹ Agricultural Economics and Rural Policy Group, Wageningen University, Hollandseweg 1, 6706KN, Wageningen, The Netherlands

nutritional status and access to socio-economic opportunities for the most vulnerable parts of the population, mainly for women and children (WFP 2014). However, food insecurity also increased in Lower Egypt between 2009 and 2011, which shows that food insecurity is not only a rural issue anymore (WFP 2013). In Lower Egypt, Greater Cairo has the largest population with poor access to food (WFP 2013). From 2005 on, food security in Egypt became worse as a consequence of several crises (an avian influenza epidemic in 2006; food, fuel and financial crises in 2008 and rising global food prices in late 2010) and increasing poverty (IFPRI-WFP 2013). The Egyptian government provides a food subsidy programme for the most vulnerable part of the population to protect them from rising food prices.

On January 25, 2011, the major political instability in the recent history of the MENA, the ‘Arab Spring’, arrived in Egypt with uprisings spilling over from the neighbouring countries of Algeria and Tunisia (for economic details, see, for example, World Bank 2015). Consequently, Egypt entered into a politically unstable situation. Protests showed dissatisfaction about the regime of President Hosni Mubarak in different cities across Egypt. Demonstrations, protests and riots continued until February 11, when Mubarak decided to resign. The political situation of Egypt remained unstable throughout 2011 experiencing frequent cases of arrests, violent clashes, shootings and other violence from both the government and protesters. By the end of the year, the political instability had caused at least 850 fatalities in the country (BBC 2011). Such violent political instability can have manifold negative effects on the economic performance of a country and the economic activity of its citizens (Blattman and Miguel 2010). It is harmful for total productivity growth and discourages physical and human capital accumulation (Aisen and José Veiga 2013). As a consequence of the political unrest, consumers and institutions relevant to trade suddenly faced extremely high uncertainty. Trading partners who previously exported wheat to Egypt were less certain about receiving payments. This might have led to increasing prices of imports and a devaluation of the Egyptian Pound, which would have made imports more expensive. At the same time, a fall in consumer confidence might have occurred. People may have spent less money and saved a larger part of their income. As aggregate demand is determined by the money supply, the velocity of money, price level and output (Mankiw and Taylor 2008) and import demand might have decreased when prices increased and money supply decreased. This fall in aggregate demand might have led to a negative shock to wheat imports into Egypt.

The analysis of food security and vulnerability in the MENA has attracted considerable attention in recent years. However, scientific evidence on the economic and food security dimensions of the Arab Spring is scarce although this uprising had substantial and lasting effects for large parts of the population in the region. El-Dukheri et al. (2011) analyzed

the farmers’ response to high food prices before the Arab Spring. They found several countries whose domestic markets were strongly affected by the global price rises but also identified several limiting factors. Wright and Cafiero (2011) analysed the response of governments in the MENA to the global food price crisis in 2007/2008. They called for an increase in stocks instead of pursuing higher degrees of food self-sufficiency. They stressed the disadvantage of substantial subsidies for food consumption, since these subsidies distort domestic price stabilization. Khouri et al. (2011) reviewed lessons learnt from this price crisis for the MENA and discuss several policy options. Lampietti et al. (2011) suggested three strategies that would be feasible and effective in the MENA for reducing the region’s vulnerability to price shocks which are the extension of domestic safety nets, the increase of domestic food production and the reduction of consumers’ exposure to food price volatility.

In this paper, we extend the analysis of vulnerability and food security in the MENA by assessing the effect of political instability on international trade. To our knowledge, it is the first paper which analyses trade-relevant externalities of the Arab Spring. This analysis is therefore a first step towards a comprehensive analysis of the economic and food security dimensions of the Arab Spring which has been the most comprehensive and most far-reaching wave of political destabilisation experienced by the MENA in recent decades. We analysed monthly wheat trade data from the Comtrade Database of the United Nations (UN Comtrade 2014) from 2010 to 2014. We statistically tested if the level of wheat imports in the months immediately after the outbreak of the Arab Spring in Egypt significantly differed from the seasonal import pattern in normal years.

The remainder of this article is structured as follows: section 2 describes the role of wheat in the Egyptian economy and policy making. The Arab spring in Egypt and the vulnerability of the Egyptian population are reported in sections 3 and 4, respectively. The next two sections give a theoretical background and describe data and methods. Results are given in section 7 and are discussed in section 8.

2 The role of wheat in the Egyptian economy and policy making

Average wheat consumption per capita at the global level is about 100 kg per year, but in Egypt the amount is substantially higher at about 225 kg per capita per year (USDA 2014). Since baladi bread¹ is the cheapest food due to high subsidies, Egyptian consumers have high incentives to take advantage of

¹ Baladi bread is made from 82% extraction (baladi) flour (IFPRI 2000; Mansour 2012).

consuming it (Mansour 2012). Baladi bread and wheat flour are available to all consumers in Egypt, without restrictions and regardless of income level (Ramadan and Thomas 2011). Figure 1 shows the difference between the production and consumption of wheat in Egypt from 2009 until 2015.

Agricultural reforms in 1987 encouraged Egyptian farmers to produce wheat. In the following years, crop yields improved due to several factors such as higher relative wheat prices, better rotation of crops, use of seed varieties that are more resistant to heat, drought and salinity, implementation of more productive cultural practices and a more liberal policy that encouraged producers to invest in modern technology (IFPRI 2000). During the period from 2004 to 2013, grain production went up from approximately 6.8 million t in 2004 to 8.5 million t in 2013 (International Grains Council 2014). However, the domestic production of wheat is, by far, insufficient to satisfy the demand, which is almost 20 million t (Fig. 1). The most limiting factors are scarcity of agricultural land and water (Solieman et al. 2015). Other factors that limit domestic production of wheat are high costs of seeds, pesticides and fertilizers (Mansour 2012). Fluctuating prices of these input factors discourage farmers from investing in new technology and in improving production practices. Egypt has a shortage of high yielding wheat seed because of a shortage in resources and land on which to produce seeds (Mansour 2012).

Importing wheat to meet the excess demand makes Egypt highly dependent on other countries and responsive to world market developments. Egypt imported 54% of its wheat in 2009 (Ramadan and Thomas 2011). The main wheat trading partners of Egypt are the Ukraine, France and Romania. Together they provide 52% of the total wheat imported by Egypt (UN Comtrade 2014). Greece is the source of 98% of all wheat flour imported by Egypt.

The wheat sector in Egypt has experienced considerable government intervention since World War II. From 1945 to 1955, the government began to control the country's wheat production and trade. Its goal was to provide the poor with access to bread and wheat flour in order to make Egyptian society more equitable (FAO 2006). After the 1987 Agricultural Reform Program was implemented, the government installed a floor price that was announced before the planting season to encourage farmers to plant wheat (IFPRI 2000). Since that time, production has not been determined by the government, only indirectly stimulated via the minimum farm-gate price. However, the government also currently continues to have considerable influence on the wheat supply chain. It gathers the locally-produced wheat through cooperatives, the Principal Bank for Development and Agricultural Credit (PBDAC) and public mills. This wheat is transformed into baladi flour. Baladi flour and bread are sold at government-licensed warehouses and bakeries at subsidized prices (IFPRI 2000, 2001). About 66% of the bread produced in Egypt is subsidized baladi bread (Mansour 2012).

Egypt knows a long history of subsidized food. Currently, baladi bread, wheat flour, sugar and cooking oil are the principal and most highly subsidized food commodities. The availability of cheap bread and wheat flour for every household in combination with the high population growth rate creates a huge and continuously rising demand for wheat. Consequently, Egypt has the highest wheat consumption level per capita in the world. Since Egyptian consumption of wheat is about twice as much as its production, Egypt is highly dependent on the world market for wheat imports.

3 The Arab spring in Egypt

Figure 2 shows that domestic food prices started to rise significantly after 2004. The food price volatility index is calculated as the standard deviation of the deviations from the trend over the previous 5 years (FAO 2013). As Egypt's dependence on wheat imports makes the country vulnerable to increasing food prices in the world market, the global price rises of 2007/2008 are also visible in the domestic food price index. This led to minor protests and strikes in 2007/2008, which called for more than just a reduction of food prices. Bush (2010) stressed that the political movement united a number of previously divided forces, which jointly and publicly expressed their critique of the president, widespread corruption in the government and brutality of security forces. Between 2010 and 2012, the currency exchange rate gradually decreased (OANDA 2015), domestic food prices were additionally driven up and food price inflation accelerated.

According to Beissinger et al. (2012), "the Arab Spring revolutions were massive political upheavals, with citizens in multiple countries taking to the streets against their respective regimes". The Arab Spring started in Tunisia and spread to almost all MENA countries. This political movement had initially no features of what is specifically characterized as 'Arab' or 'Muslim' (Roy 2012). The demonstrators were mainly concerned about their individual citizenship and not about religion or the geopolitical conflict in the Middle East between the Israelis and the Palestinians. They called for "dignity, elections, democracy, good governance and human rights" (Roy 2012).

Egypt has been ruled by former military officers since 1952 (Goldstone 2011). Before the revolution of 2011, three presidents ruled the country: Gamal Abdul Nasser (1952–1970), Anwar Sadat (1970–1981) and Hosni Mubarak (1981–2011). During the period of President Sadat, the foreign debt increased from US\$1.3 billion to US\$19.5 billion, mainly due to financing domestic consumption paired with its quickly growing population. Therefore, Mubarak was forced to start with improving the economic situation of Egypt when he came into power (Kandil 2012). At the beginning of his presidency, Mubarak also took some steps to make governance

Fig. 1 Annual production and consumption of wheat in Egypt. Source: Authors based on USDA (2014)

more democratic. In 1981, a state of emergency was proclaimed in Egypt. The Emergency Law was prolonged every 3 years by the parliament. In 1992, the Anti-Terror Law came into play as an addition to the Emergency Law. As a result, authorities acquired more power such that they could limit the basic freedoms of Egyptians. There was no (fair) trial for suspects. Strikes, demonstrations and public meetings were prohibited. Newspapers were censored or closed down. Civil society organisations were impeded from organising protests. In 2004 the start of the first wave of protests was marked by the establishment of the Egyptian Movement for Change (Kifaya). In the collective protest movements, three waves of protests can be distinguished. The first was mainly against corruption. And the second was focused on improving living conditions, such as higher wages and better working conditions. In 2008, the third wave of protests was launched in another form. Young people started a political 'Facebook' group and mobilized more than 70,000 members. Members debated mainly about concerns regarding free speech, nepotism in the government and the country's economy. They also suggested new ideas for reform in Egypt (Hassan 2011).

Fig. 2 Domestic food price volatility index in Egypt. Source: Based on FAO (2013)

The literature discusses several economic, social and political factors which decisively contributed to the outbreak of the Arab Spring. Between 2002 and 2008, the gross domestic product (GDP) grew each year by an increasing percentage. After 2008, GDP growth dropped from 7.2 to 4.7% in 2009 (Worldbank 2014). This economic stagnation could have led to dissatisfaction and possibly contributed to the revolution. It seems implausible that unemployment contributed to the revolution, since total unemployment as a percentage of the total labour force decreased in the years prior to the Arab Spring (Worldbank 2014). However, youth unemployment was high. In 2000 and 2011, youth unemployment was more than 25 and 35%, respectively (Worldbank 2014). Youssef (2011) argues that the revolution was primarily created and owned by the country's youth. Frustrations stemming from bad employment prospects might have been another important reason for the outbreak of the Arab Spring.

After 18 days of increasingly violent protests, President Hosni Mubarak resigned on February 11, 2011. From April to August, protests took place against the slow pace of political change. In November, people protested against the military, which was still in power. In that month the parliamentary

elections started. The Muslim Brotherhood won the parliamentary elections and Mohammed Morsi was nominated for the presidential elections in May 2012. Also in May, the state of emergency was ended. Mohammed Morsi won the presidential election in June, and he became the new president of Egypt. The Morsi government quickly restricted the rule of law and political freedoms, yet they did nothing to tackle Egypt's economic decline (Beissinger et al. 2012). Two years after the protests against Mubarak, Egyptians started to protest against Morsi. Finally, the military intervened and removed President Morsi from office on July 3, 2013. Interim President Mansour announced that new presidential elections would be held before the parliamentary elections. In May 2014, the former chief of the Egyptian army, Abdul Fattah al-Sisi, was elected as the new president.

4 Vulnerability of the Egyptian population

The human population pyramid of Egypt in 2010 shows that the Egyptian population is very young: 51.2% of the population is under 24 years of age, 43.3% of the population is aged between 24 and 64 and only 5.5% is older than 65 (UNDES 2012). Over the past three decades, Egypt's population has grown from 45 to 85 million, which explains the so-called demographic 'youth bulge'. According to Khalil (2011), two phenomena are connected with this youth bulge. Since Mubarak came into power, both corruption and youth unemployment reached very high levels. This combination led to despair and frustration among young graduated Egyptians. Egyptian society was neither able to provide millions of young graduates job opportunities (except for a small elite) nor prospects for a future. Despite the repressive regime, young Egyptians took another course. They used modern communication technology such as cell phones and the internet in a peaceful way to express their frustrations (Khalil 2011). Although the revolution initially was started by the young generation, people of all ages and the rich, poor and middleclass, educated or not, were involved in the revolution. They were united in their desire for change and an end to oppression (Khalil 2011).

Gini coefficients of Egypt are rather similar to Gini coefficients of western countries (World Bank 2015). Gini indices are not available for each year. The most recent numbers are 30.77 in 2008, 32.14 in 2005 and 32.76 in 2000. However, poverty headcount ratios are 15.43 in 2008, 18.46 in 2005 and 19.37 in 2000. This shows that at least 15% of the Egyptian population is living on less than US\$2 per day (World Bank 2015). According to Amnesty International (2011), around 32 million of the 80 million Egyptians were living on or near the poverty line of US\$2 a day in 2009 (see also IFPRI 2014). The Human Development Index (HDI) is an average of three indices: a long and healthy life, access to knowledge and a good

standard of living (UNDP 2013). Egypt's HDI value increased from 0.452 in 1980 to 0.682 in 2013, placing Egypt within the medium human development category (UNDP 2014). The HDI does not take into account inequality in the distribution of human development across a population at the country level. Therefore, the Inequality-Adjusted HDI has been introduced. When all three dimensions are discounted for inequality in distribution, the HDI for 2013 drops from 0.682 to 0.518 (UNDP 2014). Between 2009 and 2011, the number of Egyptians that were food insecure rose by 21% (IFPRI-WFP 2013). Figure 3 shows that Egypt faces a serious risk of food insecurity.

According to Transparency International (2014), Egypt is less corrupt than most other African countries. It seems that unique circumstances led to the outcome of the revolution in Egypt. The permanent state of emergency, population demography, youth unemployment and corruption together all played a role in the revolt.

5 Theoretical framework

Violent political conflict is likely to create negative externalities both for demand and supply in a national economy. It induces high levels of uncertainty and impedes the proper functioning of production and trade-related institutions, which may lead to distrust or higher costs. The responses of institutions, the private sector and individual actors to this uncertainty may cause significant impediments to economic activity. This was also very likely to be the case in Egypt in 2011 due to severe political destabilization and the general institutional chaos the country experienced then.

Several studies show a link between violent political instability and negative effects on national savings, investments, income and growth (Blattman and Miguel 2010). According to Aisen and José Veiga (2013), political instability can affect economic growth in three ways. It can negatively affect the accumulation of physical capital, lower technological progress and have a negative effect on human capital accumulation. Growth in physical capital and human capital is dependent on investments. Uncertainty causes people to invest less, since future returns are expected to be lower or unpredictable. Physical capital accumulation and human capital accumulation may stagnate as a result of declining investments in capital and education. Uncertainty can also slow down technological progress when research and development projects supported by firms and the government are reduced or postponed (Campos and Nugent 2002; Aisen and José Veiga 2013). According to Leduc and Liu (2014), an increase in uncertainty acts like a negative aggregate demand² shock. It raises

² Aggregate planned expenditure of consumers, producers and the government for goods and services in the economy = $C + I + G + (X - M)$

Fig. 3 Risk of food insecurity in Arab countries. The first figure below a country name shows the share of the value of food imports in the sum of total exports and net remittances in percent. The second number below a

country name shows the prevalence of child stunting in the country in percent. Source: Breisinger et al. (2012, p. 13)

unemployment and lowers inflation at the same time. Uncertainty increases the real option value of waiting (Dixit and Pindyck 1994; Lambarraa et al. 2016). Firms will temporarily pause their investment and hiring. This decrease in hiring and investment causes a reduction in the reallocation of production factors from low to high productivity firms. As a result, productivity growth falls (Bloom 2009). The effects are likely to be visible in the performance of private companies as well as public institutions carrying out the imports of food into Egypt from the world market.

Trading countries that export wheat to Egypt may be less certain about receiving payments. Therefore, import prices increase and the Egyptian currency depreciates, which makes imports more expensive. At the same time, consumer confidence is likely to deteriorate. People start to spend less money and save a larger part of their income. According to Mankiw and Taylor (2008) aggregate demand within an economy is determined by the money supply M , the velocity of money V , price level P and total output Y . The following eq. $M/P = kY$ with $k = 1/V$ shows that money supply divided by price level equals the velocity of money times the output. This shows that a price increase and reduction in money supply

lower aggregate demand. A fall in aggregate demand led to a negative shock for the wheat trade of Egypt.

Conflict can create unintended economic effects for food production and trade. Ihle and Rubin (2013) stress that military or security policies have economic side effects on food markets: including more volatile prices, commodity gluts or shortages, unemployment and higher transaction costs. According to Anderson and Marcouiller (2002), instability impedes trade by raising the prices of traded goods as a result of increased transaction costs. Transaction costs increase when contracts are poorly enforced by legal systems and if economic policy is unclear and biased. An increase in transaction costs could also have contributed to the fall in wheat demand in Egypt. General chaos in the country may have caused uncertainty among traders. Wheat sellers are less certain if wheat buyers will abide by the contract. In order to create more certainty, contracts should be adjusted. Adjustments of contracts involve higher costs, which can result in lower demand.

Public institutions can become temporarily dysfunctional because agricultural resources or storage facilities are destroyed, specialists of the national food system are removed from their positions or food distribution networks are disrupted causing

individuals to be prevented from obtaining food (D'Souza and Joliffe 2013). Probably, the revolution in 2011 disrupted food markets and distribution channels in Egypt. Egypt has limited storage capacity, which could have been full due to lower sales. Difficulties in the storage and marketing of wheat could have contributed to a fall in wheat demand. Blattman and Miguel (2010) point out that conflict can also be a consequence of food insecurity. Terms of trade volatility can stimulate armed conflict in two directions. Increased import prices can trigger conflict by suppressing the real wage. Although consensus exists around the negative impacts of political instability in the short run, there is no consensus in the literature on how long the economic effects persist (Blattman and Miguel 2010). Therefore, temporary food insecurity and vulnerability caused by trade disruptions are likely to be one major socio-economic consequence of violent political conflict. Recent empirical evidence confirms this supposition. Koren and Bagozzi (2016) found a robust association between the degree of food insecurity and armed conflict. Natalini et al. (2017) develop a model for simulating this causal link based on observed data.

6 Data and methods

The following empirical data analysis focuses on seasonal patterns of wheat grain and wheat flour imports into Egypt between 2010 and 2014 since no monthly data prior to 2010 are available. Data was obtained from the Comtrade Database of the United Nations (UN Comtrade 2014), which contains detailed merchandise data that is provided by countries and given to the United Nations Statistics Division (UN 2013). We focus on 'wheat' and 'wheat flour'. The database provides detailed information about the trading partners, net weight of wheat grain or wheat flour traded in tonnes per year and its value.

The analysis aims at finding evidence for a significant deviation in wheat imports per half year between 2011 and the other years. For this aim we performed a t-test complemented by a dummy time-series regression. The data is split into the first and second half year of 2011 and the first and second half year of all other years. In this way, the period from July to December 2011 can be compared to the same period in the other years. An independent samples t-test has been carried out. This test assumes the null hypothesis of the average monthly imports during the second half of other years is equal to the average monthly imports of the second half of 2011. Under the null hypothesis, the test statistic is distributed with 22 degrees of freedom.

As a second approach we used a time-series dummy regression model in order to test for differences in the level of imports and exports in the second half of 2011 relative to all other observations. As the emphasis of the model lies in the level of the imports, we were not interested in the autoregressive dynamics, but only in the average trade level

per half year. Therefore, the model takes the following form:

$$trade_m = \beta_0 + \beta_1 D_{2011} D_{H2} + \varepsilon_m. \quad (1)$$

The variable $trade_m$ is the observation of the m -th month of one of the four trade variables: imports of wheat, exports of wheat, imports of wheat flour or exports of wheat flour. The dummy variable D_{2011} takes the value 1 if the observation falls into the year 2011 and the dummy variable D_{H2} takes the value 1 if the observation was made in the second half (that is, in one of the months between July and December) of any of the 4 years. Therefore, the interaction between both dummies, i.e. $D_{2011} D_{H2}$, marks the observations which have been made in the second half of 2011, which is the period of interest for this analysis. Thus, the two parameters to be estimated have the following interpretation. The parameter β_0 denotes the monthly average of the variable $trade_m$ of the observations from all months except the ones in the second half of 2011. The parameter β_1 denotes the difference between this average and the monthly average of the second half of 2011. The sign of this parameter signals whether the average monthly quantity of $trade_m$ in the second half of 2011 was larger or smaller than the average of the other months. If this parameter is significant, then the result signals that there was indeed a statistically significant deviation in the pattern for the given trade variable in the second half of 2011 in comparison to the other months.

7 Results

Figure 4 shows a remarkably stable seasonal pattern of wheat import quantities, which has its maximum in the second half of each year. Except for 2011, imports peak around October or November of each year since wheat is grown as a winter crop in Egypt. The crop is sown in November and harvested in May (FAO 2014). During the growing season, Egypt has to import wheat from abroad. In the months following May, when the domestic harvest is obtained, imports decrease. Wheat has to be imported partially because the quality of the wheat produced in Egypt is poorly suited for bread-making. Therefore, domestically produced wheat is mixed with imported wheat to improve the quality (Ahmed et al. 2013). After July, wheat imports increase and peak around October until November. The General Authority for Supplies and Commodities (GASC) is responsible for purchasing wheat on the international market and for its domestic distribution. 'GASC tries to keep a 5-month supply of strategic wheat stocks' (Mansour 2012). In recent years, the private sector has also kept at least 2-months of stock, or more (Mansour 2012). The smaller peak in March each year, almost 5 months after the peak in autumn, is likely due to the run-down of the strategic wheat stocks. The visual assessment of Fig. 4 indicates the substantial deviation of the import pattern of wheat in

Fig. 4 Wheat imports into Egypt from 2010 to 2014. Numbers for months on the x-axis follow the calendar year, i.e. 1 = January, 12 = December. Source: Authors based on UN Comtrade (2014)

2011 from the other years with no peak in wheat imports during the autumn of that year.

Imports of wheat flour are much smaller in magnitude and are spread far more throughout the year. Wheat flour is also partly exported to other African countries, such as Madagascar, Burundi and Ethiopia (UN Comtrade 2014). Fig. 5 shows the seasonal pattern of wheat flour imports in t per month. Except for some peaks in November, no distinctive pattern could be found. Remarkably, from February until the middle of May in 2011 no wheat flour was reported to be imported.

For the independent samples t-test, equal variances cannot be assumed since the Levene's Test is significant. The t-test leads to a test statistic of 4.48, which corresponds to a p -value of less than 0.01. Since this p -value is less than 0.05, we rejected the null hypothesis and obtained strong evidence that the mean monthly import quantity of the second half of other years was not equal to the mean for the second half of 2011.

Table 1 presents the regression results of model (1) for all four trade variables of interest. A first look at the overall model significance shows that only the wheat import model is a meaningful statistical formulation (since it is the only model in which the p -value of the overall model significance test is less than 0.05). This goes along with the finding that in the remaining three regressions β_1 is never significant, meaning that it could be dropped. A second look at the economic significance also clearly indicates that only the wheat import model is of an economically relevant magnitude as intercept and the dummy coefficient estimates amount to 486,000 t and -300,000 t, respectively. Wheat imports amounted on average to about 400,000 t per month in 2010 and to about 340,000 t per month in 2011. The models for the other three dependent variables lack statistical significance, and are economically not relevant as the two coefficient estimates of each of them are of negligible magnitude of a few thousand tons or less.

The results of the wheat import model provide the following insights. On average, Egypt imported 485,000 t of wheat per month except for the months in the second half of 2011; 95% of these observations fell into the range of about 385,000 to 585,000 t. The estimate is significant at the 5% level, which

indicates that this monthly average is statistically significant. The large magnitude of about half a million t also stresses the economic significance of these imports for the country and confirms the trade analysis above. Of key interest is, however, the magnitude, sign and significance of the parameter β_1 . The point estimate illustrates that average monthly quantities strongly differed from the reference period during the second half of 2011; almost 300,000 t less than the average were imported in each of these 6 months. The sign is negative, stressing that the imported quantities indeed decreased on average. As the p -value amounts to 0.04, the analysis shows that this negative difference is not only large in economic magnitude, but also significant in statistical terms. This strong evidence for a substantial economic side-effect of the Arab Spring on wheat import quantities appears to be even stronger because the model is estimated by using only a small number of observations (49 observations), which stresses the relevance of the effect found.

8 Summary and discussion

This analysis aimed at assessing food-trade related externalities of violent political conflict in Egypt. It examined whether the Arab Spring, the most important phase of major political instability that shook the MENA in recent years, affected imported quantities of a key staple food. The Arab Spring broke out in Egypt in early 2011. It led to the eventual replacement of the Mubarak government and was accompanied by a major shock to political and economic institutions and actors as well as roughly 1000 fatalities.

While imports of wheat grain are of substantial magnitude of several hundreds of thousands of tonnes and show a pronounced seasonal pattern, which is closely related to the domestic cropping season, wheat flour imports do not show such a pattern and are of negligible magnitude. Exports of both commodities are also negligible. The quantity of wheat imports shows a general upward trend between 2010 and 2014. The main trading partners of Egypt for wheat imports are

Fig. 5 Seasonal patterns of wheat flour imports into Egypt from 2010 to 2014 (in t/month).
Source: Authors based on UN Comtrade (2014)

Ukraine, France and Romania. As wheat is a winter crop in Egypt, which is sown in November and harvested in May, imports decrease after May. After July, imports increase and peak around October or November.

To our knowledge, this paper is the first analysis of trade-relevant externalities of the Arab Spring and can, thus, be a first step towards the comprehensive analysis of the economic and food security dimensions of the Arab Spring. The quantitative analysis is based on a dummy time series regression, complemented by a t-test for obtaining statistical evidence on whether the Arab Spring in Egypt indeed impeded wheat imports. Both approaches provide strong evidence that the outbreak of the Arab Spring in Egypt indeed yielded a negative shock to the country's wheat imports. General chaos during the revolution, causing sudden high uncertainty for consumers and traders, which led to a fall in wheat demand, is likely to be the main cause. This is strong evidence that the Arab Spring led to temporarily impeded wheat imports, which are likely to have temporarily raised food insecurity and vulnerability in Egypt. This insight contributes a valuable case study evaluation of the economic effects of violent political conflict that Blattman and Miguel (2010) called for. Our results complement evidence from

the MENA that economic relations through trade have an inherent pacifying potential leading to reconciliation across the hostile parties of political conflicts (see, e.g. Dobers et al. forthcoming).

Although the empirical approaches adopted are quite straightforward to cover such a phenomenon, which might seem very complex on first sight, we believe the empirical strategy serves the purposes of the analysis very well. The research question focussed on assessing whether or not wheat was imported in the second half of 2011 in quantities comparable to other years in which the Arab Spring played no role. Such an analysis can straightforwardly be based on trade flow data. As regards trade flows, the question reduces then to testing with a suitable model whether there was a statistically significant deviation of significant economic magnitude from the otherwise stable annual pattern of Egyptian wheat imports. Institutional reasons causing the identified significant drop in imports might be complex and lie beyond the interest of this analysis since they are also only hardly quantifiable. We hope that further qualitative research will clarify them.

We can exclude the hypothetical argument that imports of wheat grain might have been replaced by derivatives produced from processed wheat grain during the second half of 2011 or

Table 1 Results of the time-series dummy regressions on Egyptian imports and exports of wheat and wheat flour

		Wheat imports	Wheat exports	Wheat flour imports	Wheat flour exports
Intercept β_0	Estimate	485,883	7.7	524	3562
	Standard error	50,510	4.4	52	925
	p-value	<0.01	0.08	<0.01	<0.01
Coefficient β_1	Estimate	-299,859	18.9	-212	-1014
	Standard error	144,343	12.6	149	2643
	p-value	0.04	0.13	0.16	0.70
Regression	R ²	0.08	0.05	0.04	<0.01
	Adjusted R ²	0.06	0.03	0.02	-0.02
	Overall significance (F value)	4.3	2.2	2.0	0.15
	Overall significance (p-value)	0.04	0.14	0.16	0.70
Economic significance	Average in 2010 (t)	400,973	0	410	8848
	Average in 2011 (t)	340,845	21	239	3203

Source: Authors

cereal substitutes (we thank an anonymous referee for pointing this out). As we show in Fig. 4, wheat flour imports to Egypt are of negligible magnitude amounting to about 600 t/ month while wheat grain imports amount to 200,000 to 1,200,000 t/ month. Moreover, baladi bread itself is not traded internationally so that we can also exclude the case that the grain imports were replaced by bread imports. Mansour (2012) states that the special type of bread favoured by Egyptian consumers (baladi bread) is made almost exclusively of wheat flour. Such consumption preferences are not plausibly influenced by political instabilities. Moreover, they certainly do not abruptly change in the short run. Egyptian import data for 2011 (UN Comtrade 2014) confirms that wheat has not been replaced either by wheat flour, bread or by other cereals in grain or in flour form. The evidence found of the substantial economic side-effect of the Arab Spring on wheat import quantities is emphasized by the fact that the effect is found to be significant although the underlying model is estimated by using only a small number of about 50 observations.

The quality of results of any quantitative analysis depends on the reliability of the underlying data. The data which is available in the Comtrade database and analysed here are provided by the Egyptian government. The database contains missing information for several months. The only continuous period of data was between 2010 and 2014. The quality of the collection of economic data at national level might be inversely related to the magnitude of political unrest. Political destabilization might have yielded an increased challenge to correct and complete measurement of trade flows during the Arab Spring. It might also be the case that only part of the data has been made public due to political sensitivity of this topic. However, we are not aware of objective evidence that trade data covering the second half of 2011 differed in their quality from data quantifying the trade flows in the remaining years.

Thus, this analysis is based upon the implicit assumption that data quality was not negatively affected by the political destabilization. This assumption seems reasonable as the target of the Arab Spring were mainly political symbols of the old political system of Egypt while rather technical tasks of the government such as the collection of statistical data were barely targeted. Future research on the link between data reliability and political destabilisation might yield interesting results but at the current point of time, this remains speculative. The analysis of Rubin and Ihle (2016), however, implies that (enduring) political conflict and political destabilization might also result in increased data collection efforts by governmental or non-governmental stakeholders for the sake of detailed documentation of human rights issues or conflict monitoring as it is in the case of the Israeli-Palestinian conflict.

This argument of data reliability might also be relevant for data on Egypt's wheat stocks. It would be ideal to control for these stocks in the analysis as argued by Wright and Cafiero (2011). Since stock data disaggregated on a monthly basis is not publicly available, the amounts of food commodities

stocks considered to be strategic by MENA governments during the course of the Arab Spring remain speculative. Hence, data availability and sufficient data disaggregation are likely to be considerable threats to the comprehensive analysis of the economic and food security dimensions of the Arab Spring.

However, research in economic history may shed light on these questions after a couple of decades when such data from the 2010s has lost its political weight and might therefore become publicly available. Moreover, it might also be of interest for policy makers in the MENA and for international institutions concerned with food security to examine whether similar effects such as the one found in this analysis for Egyptian wheat imports also existed for other strategic food commodities in Egypt or other MENA countries. Complementary analyses could collect individual nutritional data for an even more disaggregated analysis at the household level. Measurements of conflict intensity in the form of fatality numbers or other suitable variables as suggested by Rubin and Ihle (2016) may yield complementary insights regarding the relationship between conflict intensity and further economic variables.

This analysis has implications for international stakeholders concerned with food security and for governments of MENA countries. During violent political conflict, national governments and their proper functioning are substantially challenged. They may be replaced as a result of confrontations of an equivalent magnitude to the Arab Spring or the country may slide into a sustained civil war as has been witnessed in several MENA countries. It is likely that the effects on food imports are proportional to the severity and duration of the domestic instability. Even for usually well-functioning middle income countries, substantial effects can and will occur, as shown in this paper. International institutions should therefore be prepared to start early in their preparations for food security assistance in order to dampen the likely negative effects of food import disruptions resulting from political destabilization.

Compliance with ethical standards

Conflict of interest statement The authors declare that they have no conflict of interest.

Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

References

- Ahmed, G., Hamrick, D., Guinn, A., Abdulsamad, A. & Gereffi, G. (2013). *Wheat value chains and food security in the Middle East and North Africa region*. Duke university, USA, Centre on globalisation, Governance and Competitiveness.

- Aisen, A., & José Veiga, F. (2013). How does political instability affect economic growth? *European Journal of Political Economy*, 29, 151–167.
- Amnesty International (2011). Egypt rises: killings, detentions and torture in '25 January Revolution'. Available at: <https://www.amnesty.org/en/documents/mde12/027/2011/en/>. Accessed in Sept 2016.
- Anderson, J. E., & Marcouiller, D. (2002). Insecurity and the pattern of trade: An empirical investigation. *The Review of Economics and Statistics*, 84(2), 342–352.
- BBC (2011). Egypt unrest: 846 killed in protests - official toll. Available at: <http://www.bbc.com/news/world-middle-east-13134956>. Accessed in Sept 2016.
- Beissinger, M., Jamal, A., & Mazur, K. (2012). Who participated in the Arab spring? A comparison of Egyptian and Tunisian revolutions. Princeton University, USA. Available: <http://www.princeton.edu/~mbeissinger/tunisiaegyptcoalitions.pdf>. Accessed in Sept 2016.
- Blattman, C., & Miguel, E. (2010). Civil war. *Journal of Economic Literature*, 48(1), 3–57.
- Bloom, N. (2009). The impact of uncertainty shocks. *Econometrica*, 77(3), 623–685.
- Breisinger C., Ecker, O., Al-Riffai, P. & Yu, B. (2012). Beyond the Arab awakening. Policies and Investments for Poverty Reduction and Food Security. International food policy research institute. Available at: <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/126781/file/126992.pdf>. Accessed in Sept 2016.
- Bush, R. (2010). Food riots: Poverty, power and protest. *Journal of Agrarian Change*, 10(1), 119–129.
- Campos, N. F., & Nugent, J. B. (2002). Who is afraid of political instability? *Journal of Development Economics*, 67(1), 157–172.
- D'Souza, A., & Joliffe, D. (2013). Conflict, food price shocks, and food insecurity: The experience of afghan households. *Food Policy*, 42, 32–47.
- Dixit, A. K., & Pindyck, R. S. (1994). *Investment under uncertainty*. USA: Princeton University Press.
- El-Dukheri, I., Elamin, N., & Kherallah, M. (2011). Farmers' response to soaring food prices in the Arab region. *Food Security*, 3, 149–162.
- FAO (2006). Food security and wheat policy in Egypt. Policy Brief. Rome: Roles of Agriculture Project (ROA).
- FAO (2013). Food Security Indicators. Available at: <http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/>. Accessed in April 2014.
- FAO (2014). GIEWS country brief. Egypt: FAO Global Information and Early Warning System.
- Goldstone, J. A. (2011). Understanding the revolutions of 2011: Weakness and resilience in middle eastern autocracies. *Foreign Affairs*, 90(3), 8–16.
- Hassan, H. A. (2011). Civil society in Egypt under the Mubarak Regime. *Afro Asian Journal of Social Sciences*, 2(2.2), 1–18.
- IFPRI (2000). Wheat policy reform in Egypt - adjustment of local markets and options for future reforms. Research report. Washington, D.C., USA: International food policy research institute (IFPRI).
- IFPRI (2001). The Egyptian food subsidy system: Structure, performance and options for reform. IFPRI research report. Washington, D.C., USA: International food policy research institute (IFPRI).
- IFPRI (2014). How to build resilience to conflict: The role of food security. IFPRI food policy report. Washington, D.C., USA: International food policy research institute (IFPRI).
- IFPRI-WFP (2013). Tackling Egypt's rising food insecurity in a time of transition. Joint IFPRI-WFP Country Policy Note. May 2013.
- Ihle, R., & Rubin, O. D. (2013). Consequences of unintended food policies: Food price dynamics subject to the Israeli-Palestinian conflict. *Food Policy*, 42, 96–105.
- International Grains Council (2014). *Supply and demand*. Available at: <https://www.igc.int/en/markets/marketinfo>. Accessed June 2014.
- Kandil, H. (2012). Why did the Egyptian middle class march to Tahrir square? *Mediterranean Politics*, 17(2), 197–215.
- Khalil, P. (2011). Wildfires and ways forward: Egypt's transition to democracy. *Global Change, Peace & Security: formerly Pacifica Review: Peace, Security & Global Change*, 23(2), 249–256.
- Khoury, N., Shideed, K., & Kherallah, M. (2011). Food security: Perspectives from the Arab world. *Food Security*, 3, S1–S6.
- Koren, O., & Bagozzi, B. E. (2016). From global to local, food insecurity is associated with contemporary armed conflicts. *Food Security*, 8(5), 999–1010.
- Lambarraa, F., Stefanou, S., & Gil, J. M. (2016). The analysis of irreversibility, uncertainty and dynamic technical inefficiency on the investment decision in the Spanish olive sector. *European Review of Agricultural Economics*, 43(1), 59–77.
- Lampietti, J. A., Michaels, S., Magnan, N., McCalla, A. F., Saade, M., & Khouri, N. (2011). A strategic framework for improving food security in Arab countries. *Food Security*, 3, S7–S22.
- Leduc, S., & Liu, Z. (2014). Uncertainty shocks are aggregate demand shocks. Working paper 2012–10. San Francisco, USA: Federal Reserve Bank of San Francisco.
- Mankiw, N. G., & Taylor, M. P. (2008). *Macroeconomics*. European edition. New York: Worth Publishers.
- Mansour, S. (2012). Egypt grain and feed annual: Wheat and corn production on the rise. GAIN Report. United States Department of Agriculture Foreign Agricultural Service.
- Natalini, D., Bravo, G., & Jones, A. W. (2017). Global food security and food riots – An agent-based modelling approach. *Food Security*. <https://doi.org/10.1007/s12571-017-0693-z>.
- OANDA (2015). Available at: <http://www.oanda.com/currency/historical-rates>. Accessed in Sept 2016.
- Ramadan, R., & Thomas, A. (2011). Evaluating the impact of reforming the food subsidy program in Egypt: A mixed demand approach. *Food Policy*, 36, 638–646.
- Roy, O. (2012). The transformation of the Arab world. *Journal of Democracy*, 23(3), 5–18.
- Rubin, O. D., & Ihle, R. (2016). Measuring temporal dimensions of the intensity of violent political conflict. *Social Indicators Research*. <https://doi.org/10.1007/s11205-016-1316-3>.
- Soliman, N. Y., Barghash, R. M., & Hassan, A. A. (2015). Economic study of the impact of using some technological methods on Egyptian wheat crop productivity. *Life Science Journal*, 12(1), 12–20.
- Transparency International (2014). Corruption Perception Index: Results. Available at: <http://www.transparency.org/cpi2014/results>. Accessed in Sept 2016.
- UN. (2013). *World population prospects: The 2012 revision, volume II: Demographic profiles*. New York: United Nations Department of Economic and Social Affairs/Population Division.
- UN Comtrade (2014). International Trade Statistics Database. Available at: <http://comtrade.un.org/data>. Accessed in Sept 2016.
- UNDES (2012). *World population prospects: the 2012 revision, Volume II: demographic profiles*. United nations department of economic and social affairs/population division. Available at: <http://esa.un.org/wpp/Demographic-Profiles/pdfs/818.pdf>. Accessed June 2015.
- UNDP (2013). The rise of the south: Human progress in a diverse world. Available: http://hdr.undp.org/sites/default/files/reports/14/hdr2013_en_complete.pdf. Accessed in Oct 2015.
- UNDP. (2014). *Human development report 2014 - sustaining human progress: Reducing vulnerabilities and building resilience*. New York: United Nations Development Programme.
- USDA (2014). World wheat production, consumption and stocks. Available at: <http://apps.fas.usda.gov/psdonline/psdReport.aspx?hidReportRetrievalName=World+Wheat+Production%2c+Consumption%2c+and+Stocks+&hidReportRetrievalID=750&hidReportRetrievalTemplateID=7>. Accessed in Nov 2014.
- WFP (2013). The status of poverty and food security in Egypt: analysis and policy recommendations. Preliminary Summary Report.

Available at: <http://documents.wfp.org/stellent/groups/public/documents/ena/wfp257467.pdf>. Accessed in Feb 2017.

- WFP (2014). The world food program in 2014: Facts and figures. Annual report. Rome: World Food Programme.
- Wichelns, D. (2001). The role of 'virtual water' in efforts to achieve food security and other national goals, with an example from Egypt. *Agricultural Water Management*, 49(2), 131–151.
- Woertz, E., & Keulertz, M. (2015). Food trade relations of the Middle East and North Africa with tropical countries. *Food Security*, 7(6), 1101–1111.
- Worldbank (2014). *World development indicators*. Available at: <https://data.worldbank.org/data-catalog/world-development-indicators>. Accessed June 2014.
- World Bank. (2015). *Inequality, uprisings, and conflict in the Arab world. Middle East and North Africa (MENA) economic monitor*. Washington, D.C.: World Bank Group.
- World Bank (2016a). Country at a Glance: Egypt. Available at <http://www.worldbank.org/en/country/egypt>. Accessed in Sept 2016.
- World Bank (2016b). Population growth (annual %). Available at <http://data.worldbank.org/indicator/SP.POP.GROW>. Accessed in Sept 2016.
- Wright, B., & Cafiero, C. (2011). Grain reserves and food security in the Middle East and North Africa. *Food Security*, 3, S61–S76.
- Youssef, C. M. (2011). Recent events in Egypt and the Middle East: Background, direct observations and a positive analysis. *Organizational Dynamics*, 40(3), 222–234.

Rico Ihle is an Assistant Professor in the Agricultural Economics and Rural Policy group of Wageningen University, The Netherlands. Rico holds a PhD in agricultural economics from Georg-August-Universität Göttingen, Germany. His research interests include the analysis of agricultural prices, economic aspects of violent political conflict, the evaluation of the effects of public policies on food and the analysis of food markets in the Middle East and Sub-Saharan Africa. He is a member of the Courant Research Center "Poverty, Equity and Growth in Developing Countries: Statistical Methods and Empirical Analyses", Georg-Augustus-University, Göttingen, Germany.

Willeke Veninga obtained her MSc degree in Management, Economics and Consumer Studies from Wageningen University, The Netherlands. She specializes in agricultural economics and policy. Willeke's research interests include the effects of violent political conflicts on agricultural commodity production and trade, both in the Middle East and Eastern Europe, and increasing sustainable food production in Eastern Europe.