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Youth bulges, insurrections and labor-market restrictions

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Abstract This paper analyzes the link between large youth cohorts and violent conflicts when labor-market restrictions are present. Such restrictions are expected to limit the youth cohort's access to income opportunities in the formal economy, and thus lower the youth-specific opportunity cost of insurrection activities. We develop a theoretical model of insurrection markets and integrate the youth cohort's relative size. In equilibrium, a binding labor-market constraint interacts with the youth bulge in determining the level of insurrection activities within the society. We test the implications of our model on a sample of 135 non-OECD countries in the post-Cold War period and find the effect of the youth cohort's relative size on conflict onsets to be moderated by changes in the labor-market conditions as measured by unemployment rates. Generally, the results provide evidence that the underlying institutional setting shapes the conflict potential inherent in a given demographic structure.

Keywords Youth bulges · Demography · Insurrections · Political economy of revolutions

JEL Classification H56 · J10 · J22 · P16

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1 Introduction

When watching news reports about insurrection activities, riots, demonstrations or terrorist incidents, one is hardly ever surprised to see that most activists are young, and whenever violence is associated with these activities, it is also no surprise that most activists are male. Hence, it appears obvious that Goldstone (2002) claims that historical periods of political violence are always closely related to periods of demographically young societies. Nevertheless, a large youth cohort in the population has come under somewhat closer inspection in the social sciences only recently. Since Graham Fuller first used the term "youth bulge" in 1995 in a Central Intelligence Agency (CIA) conference report (Fuller 1995; see also Fuller 2003; Niang 2010, p. 8) to pinpoint a potential demographic source of conflict, the term has been picked up by news media (Caldwell 2007; Heinsohn 2007, 2009; Whelton 2007), and, somewhat hesitantly, also by scholarly researchers (Mesquida and Wiener 1999; Goldstone 2002; Urdal 2006; Niang 2010; Schomaker 2013).

Even so, it was no earlier than 2006 when researchers first published a systematic empirical investigation of how the demographics of a youth bulge affect political violence (Urdal 2006; see also Urdal 2004). Moreover, until then, sophisticated speculation rather than scholarly analyses dominated the search for theoretical answers to the question of if and how youth bulges cause political conflict. While many, if not most, of these sophisticated speculations have included some economic reasoning, no consistent theory has yet been provided that captures the main ideas, systematically relates them and offers testable empirical implications. In particular, no theory has been proposed explaining why young people in a youth-bulge situation are particularly prone to political violence in general and to insurrection activities in particular.

When it comes to political violence, it makes sense to distinguish spontaneous outbreaks from deliberate insurrection activities. In this paper we are interested in the latter, and we generally will refer to these types of events as "insurrection activities". Since insurrection activities are defined here as collective action toward a certain, and at least allegedly common, goal, a theory that explains youth bulges and insurrections needs to show in a consistent manner how the existence of a youth bulge facilitates an insurgent group to become effective in achieving the (alleged) common goal. This is how we aim to add to the literature. Here, we develop a theoretical framework that integrates the most important characteristics of youth bulges into a theory of insurrection activities, and then we test its predictions with empirical evidence.

In practice, grievances against a ruling elite typically relate to the distribution of wealth, of political power, or both. That is why we construct our theory around a model of a society that is dominated by a kleptocratic political and economic elite. Yet, this assumption is not necessarily consistent with reality, and our empirical work is not restricted to those types of societies. Rather, for the proposed mechanism to work it suffices that the youth cohort members perceive the government as being unjust in some sense. On this basis, we introduce a demographic factor that represents the youth bulge, as well as three hypothesized characteristics of relatively young persons, namely a risk-seeking attitude, a low potential to contribute to the traditional labor market, and a high potential to contribute to an "insurrection market".

The main implication of our theoretical model is that labor-market restrictions interact with the youth cohort's relative size in determining the aggregate level of insurrection activities within the society. We show that a rise in the youth-bulge ratio changes the ratio of marginal utilities derived from regular work, on the one hand, and insurrection activities

on the other. Yet, whether or not the resulting conflict potential actually translates into outbreaks of political violence depends on the presence of (institutional) constraints that restrict the youth cohort's members' access to the regular labor market. In brief, if labor-market regulations limit young individuals from exploiting economic opportunities in the official economy, those individuals may more easily be hired by revolutionary entrepreneurs even if marginal utility from insurrections falls short of the wage rate in the regular labor market.

The second part of the paper presents an empirical investigation of the central hypothesis derived from our theoretical model, namely the interaction effect of youth bulges and labor-market restrictions on the incidence of violent conflicts. We test this link with a panel of 135 non-OECD countries over the 1992–2012 period, approximating labor-market restrictions by changes in unemployment. Additionally, we exploit plausibly exogenous variation in youth bulges by measuring the size of the youth cohort at the time when its members where born. We find a positive and significant interaction between youth bulges and unemployment that is robust to various alternative specifications.

Our empirical analysis adds to the literature on the determinants of civil conflicts (Fearon and Laitin 2003; Collier and Hoeffler 2004; Blattman and Miguel 2010). Even though the literature offers reasons for why large youth cohorts result in institutional bottlenecks, there is, at least to our knowledge, no study that systematically integrates labor-market indicators in an empirical framework aimed at testing the demography-insurrection nexus. Thus, our paper also aims to contribute to the evidence of the link between youth bulges and civil conflicts by proposing an important institutional transmission channel that moderates the effect of demographic pressures on the society's potential for conflict (Urdal 2006; Collier et al. 2009; Campante and Chor 2012).

In the following section, we briefly clarify some fundamental definitions and concepts and we relate them to the existing literature. Based on this groundwork, we develop our theoretical model in Sect. 3. In Sect. 4, we examine empirically our central theoretical conclusions in a broad cross-country panel dataset. In Sect. 5, we discuss the implications of our results, suggest further empirical and theoretical research and conclude.

2 Some basic concepts and definitions

A youth bulge represents, at the very least, an historical demographic event during which a country starts to transition toward a modern society. At a certain point in time, both the dropping of mortality rates and the rising of per-capita incomes tend to drive birth rates down, which leads to a long population tail of adult and older people, on the one hand, and to smaller sizes of succeeding children cohorts on the other, so that a given youth cohort tends to create a "bulge" in the overall age structure of the society on its way toward modernization. Over time, this bulge works itself all the way through the age structure until it eventually disappears. Viewed that way, it makes sense to follow (Urdal 2004, 2006) by measuring a youth bulge as the youth cohort size relative to the total working-age population. Hence, the relative youth cohort size (RYCS) is what we refer to in the rest of this paper when describing the size of a youth bulge.

A youth bulge may have its merits, as it can, for example, be associated with Samuelson's (1958) biological interest rate. Hence, relatively low per-capita contributions from the youth cohort to common-pool consumption transfer systems like social security are

associated with relatively high per-capita benefits to older cohorts, which lead to particularly wealthy pensioner cohorts in some industrialized countries.

However, for members of the youth-bulge cohort themselves, these advantages hardly ever materialize. To the contrary, a demographic bulge implies a relative abundance of the respective cohort's members, starting from birth throughout the cohort members' lives. At the time when the "bulge" cohort members approach adulthood, they potentially face bottlenecks (Urdal 2006, p. 615) in search for opportunities in education and in job markets. Depending on the characteristics of the economic and political institutions, these bottlenecks tentatively lead to either real-wage drops or underemployment as well as to a general lack of career opportunities (Easterlin 1987).[1] Furthermore, as the youth cohort starts becoming competitive on job markets and in politics, the older cohorts might be inclined to limit the youth cohort's access to income-earning positions and possibly to political participation as well. Depending on the institutional background, youth cohorts may harbor grievances against the society that is keeping them down, which might, once again, depending on the underlying institutional setting, turn out to help fuel political violence (Niang 2010, p. 12).

To put it in economic terms: The bottleneck hypothesis of a youth bulge implies that the abundant youth cohort faces dropping relative prices for whatever its members contribute to society. Yet, the resulting economic and political effects (while manifold) obviously depend on numerous factors within the society's politico-institutional setting. A flexible, market-oriented setting that does not privilege incumbents holding both political and economic positions would experience different consequences from a youth bulge than would a society that systematically privileges those who already have been successful in occupying such positions in the past. As a result, if young potential successors to political and economic positions face open markets, but falling supply prices, they may still find that trying to fill traditional opportunities is more advantageous than engaging in insurrection activities.

That scenario changes when a relatively abundant youth cohort faces "closed shops", whereby members of older cohorts occupy both economic and political positions and defend those positions using administrative means. In such a case, members of the youth cohort may not be able to break into the sphere of these privileges, even if they work hard, offer better ideas and provide better services. Currently, the most dramatic example of demographic pressures interacting with institutional restrictions might explain the high conflict propensity of the Middle East. Figure 5 in the "Appendix" illustrates the relationship between poor labor-market conditions and youth bulges in Middle Eastern and North African (MENA) countries. The plot shows that most countries with some type of internal conflict, like Tunisia, Syria or Yemen, experienced either high levels of unemployment, large youth bulges or both. Even though the conflict in the Middle East is an admittedly vastly complex phenomenon in which historical, constitutional, religious and, indeed, demographic aspects interact in myriad ways that cannot be captured by simple correlations, the anecdotal evidence nevertheless indicates the we need a better understanding of how the politico-economic setting shapes the conflict potential inherent in a certain demographic structure. In fact, the existence of a large well-educated youth cohort in combination with poor labor-market prospects and repressive autocratic institutions has been

[1] These effects already have been mentioned by Goldstone (1991, p. 139): "If real wages are above average, then ...a youthful population can be stabilizing. However, if there is a precipitous drop in real wages, then ...the youthfulness of the population can increase the mobilization potential of the population".

discussed in the literature as one of the central explanations of the recent phase of political instability in many MENA countries (Austin 2011; Campante and Chor 2012).

Still, while the grievances arising from poor labor-market conditions may be a necessary condition for the youth cohort to engage in insurrection activities, it is not a sufficient condition by itself, because of the collective-action problem of revolutions (Olson 1965/1971; Tullock 1971, 1974; Lichbach 1995; Kurrild-Klitgaard 2003). Hence, while spontaneous political demonstrations and even violent riots might be explained by the development of a youth bulge in a closed-shop society alone (Kuran 1989), deliberate insurrection activities call for more than just that, namely for a more comprehensive approach to the problem. For this reason, we embed our ideas in a dual labor-market model (Grossman 1991, 1999; Wall 2006). Note, however, that we do not aim to explain collective action as such. Rather, we aim to determine the conditions under which youth-bulge societies are more susceptible to political violence than others, and our central hypothesis rests on the allocation of time by young individuals when institutional restrictions are present.[2]

In order to incorporate these ideas within a theoretical model, we assume a society that is characterized by a particularly privileged politico-economic elite that controls both the political and the economic spheres of action. While markets are relied on to a certain extent to coordinate economic activities, all productive assets are owned and operated by members of this particular elite. It is then hypothesized that such an underlying institutional setting may induce potential political entrepreneurs to enter the market for economic and political power by way of forming insurrection groups. While these entrepreneurs provide solutions for the collective-action problem underlying insurrection activities, they are driven solely by their own personal interests, that is, a desire to redistribute power and wealth away from the incumbent elites to themselves. In doing so, they hire young potential insurrection activists; this is where the effects of the youth bulge come into play.

3 An economic model of insurrections and the youth bulge

3.1 Basic model

Consider a society consisting of a ruling elite, which we refer to as the government elite G or simply the government, a competing elite, which we refer to as the revolutionary elite R, and a group of citizens. Both elite groups consist of some leading individuals plus a relatively narrow clientele. G not only runs the government, but also owns all of the shares in the economy's productive assets. Hence, while the assets are in private hands, the private owners stem from group G, and all profits flow into its members' pockets. Finally, the government elite imposes labor-income taxes on the citizens, the revenue from which the members of the elite also use for their own consumption.

The revolutionary elite R seizes resources from the part of the economy that it has brought informally under its control. It uses these resources for its own consumption as well as for hiring insurgents, who are promised compensation for their activities on the

[2] There is by now a vast amount of literature following Acemoglu and Robinson (2000, 2001, 2006) that is based on the notion of collectively sustained revolution constraints (see, e.g., Dorsch and Maarek 2015; Cervellati et al. 2014). However, this literature suffers from a number of drawbacks. In general, the literature on revolutions suppresses the micro-structure of collective action, so that it provides an ex-post rationalization rather than a causal explanation of insurrection activities (Apolte 2012).

basis of a broadly understood wage rate w_I, paid either in cash or in kind.[3] Naturally, though, the compensation promise cannot be enforced legally, which offers opportunities for the revolutionary elite to renege (Gates 2002). We hence define a measure $\rho \in [0, 1]$ of the revolutionary elite's credibility in that respect. Formally, ρ denotes the share of cases in which the revolutionary elite delivers on its compensation promise, so that the expected compensation rate is ρw_I. Finally, N citizens are neither part of G nor of R.

While governmental control over all economic activities rests formally with the government elite, that group has effective control only over those parts of the economy that are not under the informal control of the revolutionary elite. To be precise, we model the respective control capacities of the government and the revolutionary elites as shares A^G and A^R of the total productive assets in the economy. We normalize the total value of productive assets to unity, so that $A^G + A^R = 1$. While the share A^G is formally as well as effectively under the control of the government, the share A^R is only formally under the control of the government; it is effectively controlled by the revolutionaries.

Two income-generating activities are available to the citizens; one is to work in the regular labor force, and the other is insurrection. We normalize the time each individual citizen devotes to the two income-generating activities to unity. Hence, we assume that citizens allocate a fraction l to labor and another fraction i to insurrection, such that the time at their disposal is $l + i \leqslant 1$ on the level of a representative individual, and $L + I \leqslant N$ with $L = lN$ and $I = iN$ on the level of the society as a whole. As the full time portfolio of the citizens is, in principle, devoted to either work or insurrection, any situation $l + i < 1$ would result from some sort of involuntary unemployment.

Labor time is supplied to a private firm that utilizes all assets A. The private firm is run by a management that is appointed by members of the government elite and that is itself part of that elite. Insurrection activities are supplied to the members of the revolutionary elite R.

At this point, we nest the youth bulge into our model, considering the following observations:

- Bhuller et al. (2014) demonstrates that employees at the age of the youth-bulge cohort are usually far from having reached the peak of their labor-earning potentials. We therefore assume this cohort to have, on average, lower labor-market earnings than employees of older ages. We refer to this effect as the *productivity effect*.
- Insurrection activities typically consist of a conglomeration of independent individual violent attacks. Hence, each of these attacks tends to be associated with immediate feedback to the respective perpetrator. As Defoe et al. (2015) demonstrates, adolescents of the approximate age of the youth-bulge cohort exhibit a remarkably higher propensity to risky behavior, and particularly so when immediate feedback to risky activities is available. These traits lead to significantly higher rates in morbidity and mortality despite the notably good physical health of representatives of the age group at hand (Pharo et al. 2011). We hence assume members of the youth-bulge cohort to be more prone to get engaged in adventurous activities like insurrection. Moreover, we assume them to be less risk-averse in light of the questionable credibility of the revolutionary

[3] Acemoglu (2006) and Dorsch and Maarek (2015) consider the scope of tax instruments and deadweight-losses from such intervention into the economy. Since they are not critical for the point raised in this paper, we abstract from these losses.

elite to fulfill their compensation promises. We refer to this effect as the *risk-aversion effect*.

- Individuals who have grievances against the government may gain expressive utility by participating in insurrection markets, which would reduce the overall marginal disutility of "work" in that market (Hillman 2010; Wintrobe 2006, p. 178). Mainly based on Furnham (2015, pp. 19–27), we assume expressive sources of utility to apply particularly to young people, as they tend to be somewhat more passionate in their judgments and attitudes toward governments and potential revolutionaries than adults. We refer to this as the *grievance effect*.

In order to incorporate these effects into the structure of our model, we first define a youth-bulge ratio $r \in (0, 1)$. That ratio is the share of people who belong to the group of potentially economically active young men between 15 and 24 years of age to the total labor force. We then combine the youth-bulge ratio with the above-mentioned three effects at the relevant places in the model.

We start with the private firm, which we assume to utilize all productive assets A as well as labor L as inputs so as to maximize profits under conditions of perfect competition. We assume a production function of the form $F(L^e, A)$, with L^e being the effective labor supply. The production function is assumed to satisfy the *Inada* conditions in the two arguments L^e and A. In order to capture the productivity effect of the youth bulge, we define effective labor supply as $L^e = \delta r^{-1} L$, with $\delta \in (0, 1)$. The economy's output Y is then:

$$Y = F(\delta r^{-1} L, A). \tag{1}$$

Next, we model A^R as being linearly dependent on the total time I that the citizens allocate to insurrection activities:

$$A^R = \beta I \quad \text{with} \quad \beta > 0. \tag{2}$$

We assume that the government taxes labor income at a nominal payroll tax of rate t^G. However, as the government's effective control over the economy is limited by the revolutionaries' share in power, the government can tax only that part of labor income that is generated under its formal control. Since we assume a homogenous production technology, the share A^G in the assets controlled by the government is, at the same time, the share in both employment and the share of the payroll that can be taxed. The government's effective labor-income tax rate is hence $A^G t^G$. As we focus our attention on the citizens' allocation of time between labor and insurrection activities and in order to keep the analysis simple, we assume the government's decision on the tax rate t^G to be exogenous. On top of the unequal distribution of property rights, the tax rate t^G is an indicator of how harshly the government oppresses the citizens. The income Y^G of the government's elite thus is:

$$Y^G = \pi + t^G A^G w_L L, \tag{3}$$

where π are the profits of the firm, assumed to flow into the pockets of its owners who all are members of the governmental elite. Additionally, w_L is the labor-market wage rate, and L is the total number of workers employed.

The revolutionary elite, in turn, "asks" the firm's management for "contributions" based on the share A^R of capital that is under revolutionary control, at a rate of t^R. The revolutionaries' incomes can thus be written as:

$$Y^R = t^R A^R - \rho w_I I, \quad \text{with} \quad t^R \leqslant \tau^R Y, \tag{4}$$

where w_I is the compensation rate for insurrection activities, and $\tau^R \in (0,1)$ is an upper bound of what can maximally be taxed away from the capital owners' income under the power of the revolutionary elite, determined by formal or, obviously more important, informal institutions. The private firm's profit π is:

$$\pi = F(\delta r^{-1}L, A) - w_L L. \tag{5}$$

An individual citizen's utility is determined by an additively separable utility function $U = U_L + U_I$ that depends on effective net labor income as well as on the compensations for insurrection activities. Net labor income adds one-to-one to total utility, so that $U_L = (1 - t^G A^G)l$. By contrast, compensations for insurrection activities are subject to decreasing marginal utility, determined in part by the relative youth bulge ratio r, which implements the risk-aversion effect of the youth bulge. In order to also implement the grievance effect, we introduce a variable $\mu \in [0,1]$, which indicates the desire, if any, to express one's discontent with the government: A value of $\mu = 0$ indicates perfect acquiescence to the incumbent's actions, while rising utility by expressing sympathy with the revolutionary elite successively raises the level of μ to a maximum of $\mu = 1$. As argued above, young citizens derive more utility from expressing criticism of the government. In order to keep things simple, we implement this feature of the model by assuming $\mu = 0$ for all individuals except the members of the youth cohort. This assumption allows us to interact μ with the youth-bulge ratio r in order to measure an average citizen's attitude toward the government by $r\mu$. That interaction variable captures the risk-aversion effect with its component r and the grievance effect with its component μ. We define $U_I = \rho((1 + w_I)^{r\mu} - 1)i$ as the expected utility of insurrection activities. Total utility $U = U_L + U_I$ is hence given by:

$$U = (1 - A^G t^G)w_L l + \rho((1 + w_I)^{r\mu} - 1)i. \tag{6}$$

Note that the utility from compensation for insurrection activities turns out to be zero when $\mu = 0$ or $\rho = 0$, or both. That marks the limiting case wherein insurrection activities are non-rewarding from the point of view of the citizens. For any $\rho > 0$, a positive μ will be magnified by rises in the youth-bulge ratio r. Note further that for $r = \rho = \mu = 1$, the utility of compensations for insurrection activities is simply w_I, which therefore maps one-to-one into utility in precisely the same way that the net wage on the formal labor market does. This situation reflects the limiting case of no risk aversion, full credibility of the revolutionary elite's compensation promise, and a maximum degree of grievance against the government. From the point of view of the citizens, insurrection activities are then a perfect substitute for regular work.

The final element to be incorporated into our model is a simple labor-market imperfection. In particular, we assume a restriction on the side of the labor suppliers in the form of a probability $\varepsilon \in (0,1)$ of being unemployed. Since each citizen's time devoted to either work or insurrection is normalized to unity, and since the only legal way of spending time for income generation is to work on the regular labor market, the level of full employment on that market is simply N. Our relevant labor-market restriction will hence be $L \leqslant \varepsilon N$. On the individual citizen's level, then, labor supply will be restricted by $l \leqslant \varepsilon$. Within the framework described above, the firm, the revolutionary elite, and the citizens will maximize their respective objective functions.[4]

[4] A detailed formal analysis of the following is provided in the "Appendix".

The management of the firm takes $F(\delta r^{-1}L, A)$ and w_L as given and maximizes net profits. Given (5), the first-order condition is:

$$w_L^* = \delta r^{-1} F'(L). \tag{7}$$

As we assume competition on both the labor market and the market for insurrection activities, the revolutionary elite maximizes $t^R A^R - \rho w_I I$, subject to $t^R \leq \tau^R Y$. Given (2) and (4), the Kuhn–Tucker conditions for a maximum of Y^R with respect to L imply:

$$w_I^* = t^R \beta \rho^{-1} \quad \text{for } I > 0; \quad w_I^* \geqslant t^R \beta \rho^{-1} \quad \text{for } I = 0; \quad \text{and} \quad t^R = \tau^R Y \quad \text{for } \lambda > 0. \tag{8}$$

The condition $w_I^* \geq t^R \beta \rho^{-1}$ for $I = 0$ is of no relevance for either the citizens or the revolutionaries, so we do not consider that case any further. The condition $t^R = \tau^R Y$ for $\lambda > 0$ simply says that the revolutionaries will take whatever the upper bound τ^R allows them whenever the restriction $t^R \leq \tau^R Y$ is binding.

Finally, the citizens maximize (6) subject to their time restriction $l + i \leq 1$ and subject to the labor-market restriction $l \leq \varepsilon$.

3.2 Equilibria

We focus on two cases. In case A, the time restriction is non-binding, while the labor-market restriction is binding; and in case B, the time restriction is binding, while the labor-market restriction may or may not be binding.

Case A is illustrated in Fig. 1.[5] $(1 - t^G A^G)\delta r^{-1} F'(L)$ represents net marginal productivity net of taxes on the regular labor market. The prevailing wage rate $w_L > w_L^e$ determines an employment level $L \leqslant N$, while the market-clearing wage rate w_L^e would lead to full employment if it were not for the labor-market restriction. Because of the latter, however, employment falls short of N, leaving unemployment of $(1 - \varepsilon)N$. However, as long as $\rho(1 + t^R \beta \rho^{-1})^{r\mu} = 0$, such that no utility can be generated by engaging in insurrection activities, the $(1 - \varepsilon)N$ unemployed labor will not be reallocated to the market for insurrections.

Case A is a very simple case in which the citizens supply labor only to the regular labor market, either because marginal productivity in the market for insurrections is zero, because the promises made by the revolutionary elite to compensate citizens for insurrection activities is not credible, or because the citizens are fully loyal to the government. For the latter two cases, $\mu = 0$ applies. However, the labor-market imperfection in combination with the lack of opportunities in the market for insurrection activities deters citizens from allocating all of their time designated for income generation to either regular work or insurrection activities. This is different in case B.

Case B comprises case A, since it gives the conditions for an optimal time allocation for all situations wherein the marginal utility from insurrection activities is sufficiently attractive to citizens to set $i > 0$, so that they allocate at least some time to these activities.[6]

Case B is depicted in Fig. 2.[7] It shows citizens' marginal utilities from labor-market activities [i.e., $(1 - t^G A^G)\delta r^{-1} F'(L)$] and from insurrection activities [i.e.,

[5] See the "Appendix" for the formal details.

[6] We rule out possible situations with no labor-market restriction and, at the same time, utility from insurrection activities is less than the net effective wage rate even with full employment, so that insurrection activities are never worthwhile.

[7] See the "Appendix" for the formal details.

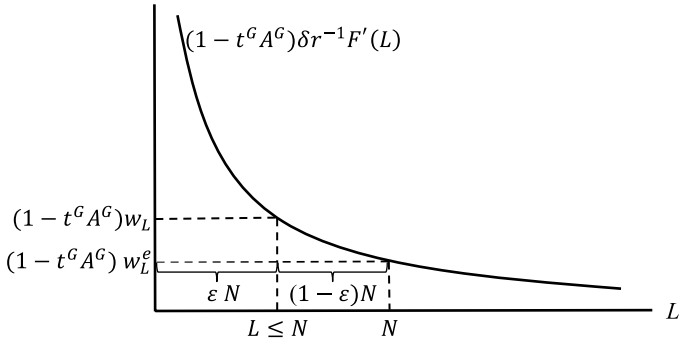

Fig. 1 Case A

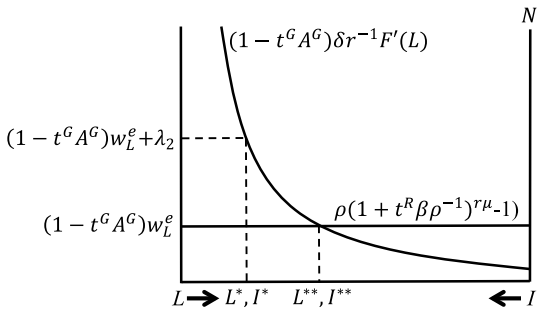

Fig. 2 Case B

$\rho((1+t^R\beta\rho^{-1})^{r\mu}-1)]$. Insurrection activities i and labor-market activities l always sum to one for each citizen in case B, so that we have $L+I=N$ at the macro-level. If the labor-market restriction were non-binding, as indicated by $\lambda_2=0$, an equilibrium would be reached at L^{**}, I^{**}, where the marginal utilities derived from the respective activities are equal. With a binding labor-market restriction, though, with $\lambda_2>0$, the activity levels in the respective markets in equilibrium are L^*, I^* with less regular work and more insurrection activities than L^{**}, I^{**}, even though the marginal utility of insurrection activities falls short of the net effective wage rate in the regular labor market. Note that an increase in the youth-bulge ratio r shifts the marginal utility curve in the labor market downwards and the marginal utility curve in the market for insurrections upwards. Hence, a larger youth bulge will reallocate time away from work in the regular labor market and toward insurrection activities.

Case B can be used for fixing the central empirical implications of our model. Assume, for simplicity, a Cobb–Douglas production function in the labor market with α as the output elasticity. Then the equilibrium condition (A.19) in the "Appendix", in combination with the condition $N=L+I$ of case B, turns into:

$$I=N-\left(\frac{(1-t^GA^G)\delta\alpha}{r\rho((1+t^R\beta\rho^{-1})^{r\mu}-1)+r\lambda_2}\right)^{\frac{1}{1-\alpha}} \tag{9}$$

Generally speaking, the term in large parentheses on the right-hand side indicates the opportunity costs of working in the regular labor market in terms of foregone utility from insurrection activities. As these opportunity costs rise, insurrection activities will rise, too.

4 Empirical evidence

Our model has a number of empirical implications both in general and with respect to the youth bulge. The general implications are:

1. Productivity in the regular labor market, relative to the productivity of insurrection activities, is a key factor for determining the allocation of time between regular work and insurrection activities. Consequently, a decline in either δ or α, and an increase in $t^R\beta$ tend to raise insurgence activities at the aggregate level. Hence, it is not low productivity or, for that matter, low wages and poverty as such, that drive people into insurrection activities, but it is the ratio of utility between the two income-generating activities, namely labor or insurrection, that counts. This is very much in line with now-established findings of the economic theory of terrorism, according to which terrorist activists are by no means recruited from groups of people with low incomes and poor educations (Sageman 2004; Krueger 2008; Krieger and Meierrieks 2011).
2. Unemployment is another key factor influencing the allocation of time between insurrection activities and regular work. Tighter labor-market restrictions, as indicated by λ_2, raise insurgence activities simply by restricting career options in the official labor market.
3. The degree of oppression exercised by the government, as indicated by the government's effective tax rate $t^G A^G$, lowers the opportunity costs of insurrection activities and, hence, raises their levels. Note that this effect materializes even for citizens with perfectly rational expectations regarding the production of the (perceived) public good associated with insurrections. The reason is that oppression changes the opportunity costs of one activity in terms of the other, and that changes the citizens' optimal allocations of time.

With respect to the youth bulge, we have further implications. A rise in the youth-bulge ratio tends to drive people away from the regular labor market into insurrection activities. This follows from $I'(r) > 0$ in Eq. (9). Three main effects underlie that conclusion:

(a) The youth-bulge ratio reduces the degree of risk aversion regarding the utility derived from insurrection activities. This follows from $r\mu$ in Eq. (9).
(b) The youth-bulge ratio changes the relationship between the utility derived from work, on the one hand, and the utility derived from insurrection activities on the other. This is given by the first r in the denominator of (9).
(c) Finally, the youth-bulge ratio interacts directly with the labor-market restriction, as can be seen by the term $r\lambda_2$ in (9). Hence, a rise in the youth bulge, in combination with poor labor-market prospects, once again lowers the opportunity costs of insurrection activities.

The labor-market restriction appears to be of particular importance. It suggests that it is not the youth bulge itself that magnifies the threat of insurrection activities. It is rather the interaction of a high percentage of the youth cohort (specifically, a high percentage of young men) compared to the rest of the economically active population, with few labor-market

opportunities that matters. Labor-market restrictions are reflected most directly by (involuntary) unemployment. Importantly however, our model's prediction does not depend on the specific source of the labor-market restriction. Although our policy implications focus on institutional factors, shifts in the optimal time allocation are independent of this source, be it cyclical or institutional. Hence, we should find that unemployment affects insurrection activities independently of its source and this is what we test in the following analysis.

4.1 Estimation strategy and data

Rather than applying a rigorous test of our theoretical model, we focus on the reduced-form estimation of one specific aspect of it, namely the interaction effect of youth bulges and labor-market restrictions on the outbreak of insurrections.[8] The baseline specification of our empirical model is as follows:

$$\begin{aligned}\text{Prob}\,(I_{i,t}=1) = {} & \phi_i + \theta_t + \psi_{r,t} + \gamma_1 RYCS_{i,t-1} + \gamma_2 UE_{i,t-1} + \gamma_3 RYCS_{i,t-1} \times UE_{i,t-1} \\ & + X'_{i,t-1}\mathbf{\Gamma} + \nu_{i,t}\end{aligned} \tag{10}$$

where i denotes countries and t denotes years. The dependent variable, $I_{i,t}$, is a binary indicator that equals one when an insurrection onset is observed in a given country-year. The explanatory variables of interest are the (1-year lagged) relative youth cohort size, denoted by $RYCS_{i,t-1}$, and the labor-market restriction (measured by changes in unemployment), which we denote by $UE_{i,t-1}$. Our main focus is on γ_3, the coefficient of the interaction effect of $RYCS_{i,t-1}$ and $UE_{i,t-1}$. The specification includes country fixed effects, ϕ_i, that control for time-invariant differences across countries, and year fixed effects, θ_t, that control for common shocks. In addition, we enter region-year fixed effects, $\psi_{r,t}$, that account for regional developments, such as the spread of new technologies (e.g., contraception). The vector $X'_{i,t-1}$ captures further time-varying controls that are included in some estimations, such as population and level of economic development. The disturbance term ($\nu_{i,t}$) is allowed to be serially correlated and heteroscedastic.

To obtain data for insurrection activities, we rely on the UCDP/PRIO Armed Conflict Dataset Version 4-2013 (Themnér and Wallensteen 2013). We focus on intrastate insurrection events defined as a "contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths" (Gleditsch et al. 2002, p. 509). Comparing different data sources such as the Archigos leader transition dataset (Goemans et al. 2009) or Bank's data on domestic conflicts (Banks and Wilson 2015), we believe that the UCDP/PRIO conflict measures are theoretically most relevant as they focus on disputes between governments and rebellious groups that have at least some organizational structure. That definition reflects our model's set-up of a revolutionary elite recruiting young activists to conduct political violence. We consider both minor conflicts (25–999 battle-related deaths per year) and civil wars (with 1000 or more fatalities per year).

Since countries often remain conflict prone after the occurrence of an insurrection event, and ongoing insurrections are likely to have feedback effects on the demographic and economic characteristics of a country, we focus on the *onset* of a conflict period rather

[8] In the following, we use the terms "insurrection" and "conflict" interchangeably as our (empirical) conflict measure closely resembles what we modeled as "insurrections" in the theoretical section.

than the durations of insurrections. We code the onset of a new insurrection only if there is no ongoing conflict in the current or previous year, and we exclude from our analysis all country-years of ongoing conflicts (Collier and Hoeffler 2004; McGrath 2015). We also control for time dependence as suggested by Carter and Signorino (2010) and include the number of years elapsed since the last insurrection onset, as well as its squared and cubic terms (t, t^2, t^3) in our regression.

Regarding our main explanatory variable of interest, we calculate the *RYCS* as the ratio of the male youth cohort (aged 15–24 years) relative to the total economically active population (ages 15–69). A thus-defined youth-bulge ratio reflects the degree of competition over resources and working opportunities that the members of the youth cohort face when entering the labor market.[9] Moreover, we focus on the share of young men among the working population, assuming that the relative abundance of men (rather than women) is the key factor that leads to violent conflict (Moller 1968). In fact, Mesquida and Wiener (1999) shows that (young) men historically have been the main recruits for fomenting social unrest and rebellions, while in many traditional societies, women are not encouraged to participate in demonstrations and public protests. Yet, as shown in the robustness section, our results are not sensitive to alternative definitions of the youth cohort. Demographic data are taken from the UN World Population Prospects (UNWPP, see United Nations 2015).

Our theoretical model implies that a binding labor-market restriction producing involuntary unemployment interacts with the youth-bulge ratio, irrespective whether this restriction is associated with economic shocks or inefficient regulation. We therefore rely on changes in unemployment as our preferred measure of such a labor-market constraint. More precisely, we include annual changes in the country-level unemployment rate, which is defined by the International Labor Organization as the share of the labor force without work but available for and seeking employment. Those data are obtained from the World Development Indicators (World Bank 2016). Since internationally comparable employment data are available for a large number of countries only from 1991 onward, our sample is restricted to the time period after the end of the Cold War.

One might prefer measuring institutional restrictions in terms of formal and informal entry barriers. However, data on these measures rarely are available on a broad cross-country time-series basis and, even if so, often omit conflict-prone countries. Nonetheless, we still aim to capture the institutional dimension of labor-market restrictions more directly, so we also analyze the effect of the youth bulge when it interacts with two indices representing the regulatory qualities of labor-market institutions. Such indices are provided by the Heritage Foundation (2016) as well as the Fraser Institute (Gwartney et al. 2016). Yet, owing to data limitations, the results based on these institutional variables reflect at most tentative support for the cross-country heterogeneity of the youth-conflict nexus. We, nevertheless, are confident that it is safe to rely on unemployment data as our preferred proxy for the labor-market restriction, in part because recent studies also have relied on that proxy in cross-country analyses of political conflict (Berman et al. 2011; Campante and Chor 2012). Moreover, Korenman and Neumark (1997) found evidence that less flexible labor-market institutions lead to larger changes in unemployment when the youth cohort size varies through time.

[9] We refrain from relating the youth cohort size to the total population as such a measure might seriously underestimate the extent of a youth bulge in the presence of continued high fertility rates (Urdal 2004, 2006).

Yet, anticipation of future conflicts might affect current investment behavior (and thus labor-market outcomes) as well as migration decisions (and thus the population's age structure). Moreover, unobserved time-varying factors might influence both the conflict potential of a society as well as demographic and economic characteristics (Blattman and Miguel 2010). To account for these potential sources of reverse causality and joint identification, we exploit an alternative source of variation in the demographic structure of a country that is more robust to those concerns. More precisely, we use the relative size of the youth cohort at the time when its members were born (i.e., in t-15 to t-24), and label that variable *RYCS* (at birth).[10] The current size of the youth cohort might be influenced by the migration decisions of individuals, which might be related to a country's conflict history, or by battle-related deaths that disproportionately reduce the size of that cohort relative to others. Yet, we can plausibly assume that these concerns do not apply to the size of the youth cohort at birth years. Controlling for time and country fixed effects ensures that the results are not driven by unobserved factors.[11]

Since we standardize our measure of relative youth cohort sizes, the interaction coefficient γ_3 from Eq. (10) gives the differential effect of a rise in unemployment in countries with an above-average youth bulge. While the main effect of unemployment clearly can be endogenous to conflict, our focus is on the heterogeneous treatment effect of labor-market shocks (in terms of rising unemployment) in different demographic settings. Nizalova and Murtazashvili (2016) show that interacting an arguably exogenous variable (*RYCS* at birth) with a potentially endogenous variable (unemployment) can be interpreted as exogenous when controlling for the main effect of the endogenous variable.[12] Thus, the *differential* effect of a rise in unemployment in countries with larger youth bulges is unlikely to flow through channels other than the labor-market constraints imposed on the youth cohort in these countries. Our identification strategy closely follows recent studies on the effects of aid on civil conflicts (Nunn and Qian 2014) and on economic growth (Dreher et al. 2015).

Finally, we include a number of baseline controls that could introduce omitted variable bias. We include overall population size and the growth of the urban population (both taken from UNWPP) because a positive coefficient on the youth-bulge ratio might simply reflect overall population pressures, which in turn may be most critical in urban centers. Similarly, a country's demographic transition is likely to be correlated with its economic development, which also influences the risk of conflict (Bloom and Williamson 1998). For this reason, we include gross domestic product (GDP) per capita (p.c.) in levels and its growth rate obtained from the Penn World Table Version 7.1 (Heston et al. 2012). In addition, we control for the degree of political instability of a country, defined as a three-point or larger change in the combined Polity2 score over the previous 3 years (Marshall et al. 2016), following Fearon and Laitin (2003). Finally, we also account for potential contagion effects and the regional dimension of many conflicts by counting the total number of neighboring countries that experience insurrection activities in a given year.

[10] Technically, we use the size of the cohort of the 0-to-9-year-old males at time t-15 [which becomes the youth cohort (aged 15–24) in t]. In the denominator, we include the size of the population aged zero to 54 in t-15 [which becomes the total working population (aged 15–69) in t].

[11] Similar approaches are applied in studies of the relationship between youth cohorts and labor-market outcomes (Korenman and Neumark 1997) and in the literature on demography and economic growth (see, for example, Bloom and Williamson 1998).

[12] See Angrist and Krueger (1999) for a technical discussion of this condition.

Regarding our estimation strategy, we apply fixed-effects least-squares (FELS) techniques that allow for flexible specifications, such as the inclusion of interaction terms (Bazzi and Blattman 2014; Nunn and Qian 2014). Even though logit or probit techniques more adequately capture the non-linear functional form when the dependent variable is dichotomous, the computation and interpretation of interaction effects, which is central to our analysis, is not straightforward in these models. In particular, Ai and Norton (2003) show that the interaction effects might have different signs and magnitudes for each observation in logistic regressions. For this reason, we estimate a linear probability model (LPM). Angrist and Pischke (2008) argue that the LPM often performs well with limited dependent variables. As shown below, our results are robust to non-linear estimation techniques as well.

Our baseline sample is a panel of 135 non-OECD countries for the years 1992–2012. It includes 82 insurrection onsets according to the above-specified criteria. Summary statistics for the baseline sample are shown in Table 1.[13]

4.2 Baseline results

In columns (1) and (2) of Table 2, we present the results of a simple cross-sectional ordinary least squares (OLS) estimation that includes only our variables of main interest [i.e., *RYCS* (at birth), unemployment changes and the interaction term], controlling for year, region and region-year fixed effects. We find a positive and significant correlation between youth bulges and the probability of a conflict onset, replicating the standard result from the literature (Urdal 2006; Collier et al. 2009). However, the youth-bulge effect does not unconditionally impact on the risk of an insurrection onset, but instead interacts with the surrounding labor-market conditions. The positive sign of the interaction coefficient in column (2) indicates that the effect of a one-percentage-point increase in unemployment on the probability of an insurrection onset is larger in countries with above-average youth bulges than in countries with an average youth-bulge ratio.

Since there might be unobserved country characteristics, we include country fixed effects in column (3) of Table 2. While the youth-bulge coefficient is no longer significant, the interaction between *RYCS* (at birth) and unemployment remains statistically significant throughout the analysis. Our preferred model specification is reported in column (4) where we add our baseline control variables. The coefficient of overall population size is significant and negative, suggesting that for a given age structure, larger populations are not per se more conflict-prone. That finding is supported by the positive estimate of the urban population growth rate. While economic development and growth have been shown to be robust predictors of civil conflicts in cross-sectional studies (Fearon and Laitin 2003; Collier and Hoeffler 2004), we do not find those variables to have significant effects in our panel estimations. Yet, that result is in line with recent evidence that accounts for country effects and time persistence (Bazzi and Blattman 2014). Also, political instability is not significantly associated with insurrection onsets in our sample. The negative coefficient of the total number on neighbors at war might indicate that countries in conflict-prone regions simply are more likely to be involved in a conflict as well (with the conflict years dropping out of the sample).[14]

[13] We provide an online appendix that contains additional information on the definitions and sources of all variables included in our analysis.

[14] One concern with the included controls is that they might be endogenous to insurrections and tend to be correlated with each other (Burke et al. 2014). Therefore, we treat these controls with caution and also present results without them. Nevertheless, our results do not depend on the chosen number and definition of the control variables. Additional regression results are available from the authors.

Table 1 Summary statistics

Variable	Observations	Mean	SD	Min.	Max.
Insurrection onset	2350	0.035	0.184	0	1
RYCS	2350	0.154	0.034	0.077	0.222
RYCS (at birth)	2350	0.149	0.033	0.072	0.208
Unemployment (changes)	2350	− 0.031	1.541	− 12.4	18.2
Population in thousands (ln)	2107	8.900	1.453	5.799	14.109
Urban population growth rate	2107	2.554	2.215	− 7.103	17.900
GDP p.c. (ln)	2107	8.233	1.231	5.081	11.822
GDP p.c. growth rate	2107	0.028	0.078	− 0.510	1.154
Political instability	2107	0.140	0.348	0	1
No. of neighbors at war	2107	1.751	1.699	0	7

RYCS relative youth cohort size; *GDP p.c.* gross domestic product per capita

In quantitative terms, the results in column (4) of Table 2 suggest that the effect of a one-percentage-point increase in unemployment on the risk of an insurrection onset is 0.616 percentage points higher in a country with a male youth-bulge ratio of 18% (corresponding to the 75th percentile of the sample distribution) than in a country with a male youth-bulge ratio of 15% (corresponding to the sample mean).[15] In other words, relative to the average probability of an insurrection onset, which is 3.5%, a one-percentage-point increase in unemployment raises the risk of a conflict onset by roughly 21% when going from a country with an average youth bulge of 15%, like Ecuador in 2003 or Botswana in 2010, to a country with a youth bulge of 18%, like Somalia in 2005 or Syria in 2006.

We are also interested in the marginal effect of the youth-bulge ratio, which depends on the labor-market conditions in the economy. We therefore calculate the marginal effect of *RYCS* (at birth) over the range of unemployment changes that we observe in our sample and show the result in Fig. 3. The figure shows that the marginal effect of the relative youth cohort size increases with rising unemployment and becomes significant for changes in unemployment of approximately 4.8 percentage points and more.

In column (5) of Table 2, we include the averaged values of the control variables from column (4) for the years t-15 to t-24 to account for the fact that these covariates might be correlated with the relative youth cohort size at birth years and have a persistent impact on the conflict risk of a country (coefficients not shown). The coefficient of the interaction effect remains positive and significant, while the coefficients of most of the additional controls are not significant. Finally, in column (6) and (7), we show that our baseline results are robust when we include the current youth-bulge ratio instead of *RYCS* (at birth). The estimates of the interaction term are similar in magnitude to our baseline estimates, suggesting that fluctuations in cohort sizes over time are not a major concern in our analysis and that *RYCS* (at birth) is in fact a valid proxy for the current *RYCS*. Yet, we cannot ultimately rule out that current variations in youth cohorts are caused by the propensity of

[15] For a country with *RYCS* (at birth) at the sample mean (= 0.149), the standardized value of this variable is zero. Thus, the overall effect of a one-unit increase in *UE* (= unemployment changes) at *RYCS* (at birth) = 0.149 is simply $\hat{\gamma_2}$. For a country with *RYCS* (at birth) = 0.177, the standardized value is 0.848. The overall effect of a one-unit increase in *UE* at *RYCS* (at birth) = 0.177 is therefore $\hat{\gamma_2} + \hat{\gamma_3} * 0.848$. The differential effect of a one-unit increase in *UE* is the difference in both effects, or $\hat{\gamma_3} * 0.848 = 0.00727 * 0.848 = 0.00616$ (i.e., 0.616 percentage points).

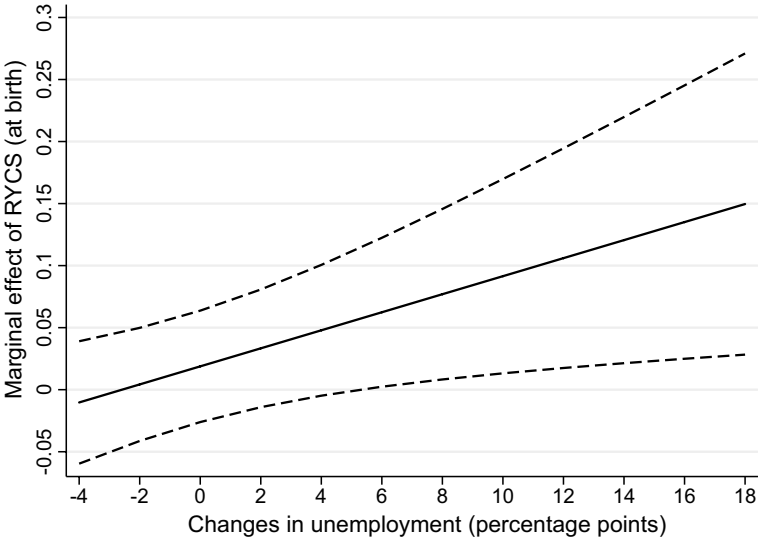

Fig. 3 Marginal effects of *RYCS* (at birth) as unemployment changes. *Note* Marginal effects of *RYCS* (at birth) on the likelihood of an insurrection onset at representative values of unemployment (changes), using the observed values for all other variables. The marginal effects are estimated for model (4) in Table 2. The dotted lines indicate the 90% confidence interval

conflict onsets. Therefore, the inclusion of the more robust youth-bulge measure appears justified on these conceptual grounds. Importantly, the *differential* effect of an increase in unemployment on the likelihood of an insurrection onset in countries with above-average youth bulges (at birth years) is unlikely to arise through channels other than adverse labor-market conditions. Thus, the interaction effect indeed captures the moderating role of labor-market restrictions on the demography-conflict nexus.

4.3 Alternative labor-market indicators and heterogeneous effects

The main implication of our theoretical model states that whenever a binding labor-market restriction exists in the sense of unemployment, individuals have an incentive to shift labor supply from the official labor market to insurrection activities, and this is particularly the case for young individuals. While the underlying cause of an increase in unemployment could be both economic shocks along with inefficient labor-market institutions, this prediction does not depend on the source of the labor-market restriction. Still, from a policy perspective, we are more interested in the effect that inefficient regulatory rules have on young individuals' access to the regular labor market and the related potential for political grievances to erupt. To test the effect of institutional constraints on the youth-conflict nexus, we enter two indicators of the regulatory quality of labor-market institutions in our model in Table 3. Data are drawn from the Heritage Foundation's Index of Economic Freedom and the Economic Freedom of the World Index provided by the Fraser Institute (Gwartney et al. 2016). Both indices reflect the legal framework of a country's labor market, with higher values indicating more flexible laws and fewer regulatory constraints, such as

Table 2 Baseline results

Dependent variable: insurrection onset	Pooled OLS, *RYCS* (at birth)		FELS, *RYCS* (at birth)			FELS, current *RYCS*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
RYCS (at birth)	0.0126***	0.0125***	0.0145	0.0188	0.0131		
	(0.00477)	(0.00473)	(0.0238)	(0.0273)	(0.0410)		
RYCS						0.00978	0.00990
						(0.0196)	(0.0237)
Unemployment (changes)	0.00281	0.00581	0.00565	0.00580	0.00934**	0.00529	0.00539*
	(0.00308)	(0.00389)	(0.00354)	(0.00358)	(0.00393)	(0.00321)	(0.00322)
RYCS (at birth) × unemployment (changes)		0.00729*	0.00673**	0.00727*	0.00954*		
		(0.00372)	(0.00329)	(0.00369)	(0.00504)		
RYCS × unemployment (changes)						0.00653**	0.00697**
						(0.00294)	(0.00325)
Population (ln)				− 0.134*	− 0.330**		− 0.129
				(0.0796)	(0.143)		(0.0797)
Urban population growth rate				0.00757	0.0100		0.00705
				(0.00469)	(0.00826)		(0.00468)
GDP p.c. (ln)				0.0267	0.0259		0.0274
				(0.0240)	(0.0319)		(0.0243)
GDP p.c. growth rate				0.0902	0.0652		0.0881
				(0.0899)	(0.0986)		(0.0911)
Political instability				0.0181	0.0157		0.0183
				(0.0186)	(0.0228)		(0.0185)
No. of neighbors at war				− 0.0116*	− 0.0164**		− 0.0115
				(0.00697)	(0.00749)		(0.00701)
Year FE	Y	Y	Y	Y	Y	Y	Y
Country FE	N	N	Y	Y	Y	Y	Y
Region FE	Y	Y	N	N	N	N	N

Table 2 (continued)

Dependent variable: insurrection onset	Pooled OLS, *RYCS* (at birth)		FELS, *RYCS* (at birth)			FELS, current *RYCS*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Region-specific trends	Y	Y	Y	Y	Y	Y	Y
Time since last insurrection onset (t, t^2, t^3)	Y	Y	Y	Y	Y	Y	Y
Additional controls	N	N	N	N	Y	N	N
R-squared	0.041	0.045	0.031	0.044	0.055	0.031	0.044
Number of countries	135	135	135	133	102	135	133
Observations	2350	2350	2350	2107	1556	2350	2107

Standard errors (in parentheses) are clustered at the country level. All explanatory variables are lagged by 1 year. Region dummies are included in column (1) and (2) for Asia, North Africa and the Middle East, Sub-Saharan Africa, and Latin America and the Caribbean. Column (5) includes, in addition to the baseline controls from column (4), averaged values of these variables for the years t-15 to t-24 (except for the instability variable that measures the overall change in the Polity2 score between t-15 and t-24)

OLS ordinary least squares, *FELS* fixed-effects least-squares, *RYCS* relative youth cohort size, standardized

Significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table 3 Robustness

Dependent variable: insurrection onset	Labor-market regulation		Heterogeneous effects				Dynamic specifications			Logit
			Indicator variable for							
	Heritage	Fraser	Democracy	Years of schooling	Tertiary schooling	Resource rents	FELS	LSDVC	GMM	AMEs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
RYCS (at birth)	0.0178*	0.0239*	0.0647**	0.0522	0.0535	0.0210	− 0.0117	− 0.0113	0.0366	0.0165*
	(0.00939)	(0.0134)	(0.0288)	(0.0406)	(0.0375)	(0.0296)	(0.0256)	(0.0228)	(0.0236)	(0.00930)
Labor regulation	0.00788	− 0.0126								
	(0.00895)	(0.0107)								
RYCS (at birth) × labor regulation	− 0.0137*	− 0.0211**								
	(0.00814)	(0.00873)								
Unemployment (changes)			0.000326	− 0.00519	0.00328	0.00329	0.00554	0.00545*	0.00611**	0.00509**
			(0.00378)	(0.00789)	(0.00262)	(0.00284)	(0.00343)	(0.00286)	(0.00277)	(0.00246)
RYCS (at birth) × unemployment (changes)			0.0224**	0.0342*	0.00987*	0.00512*	0.00671*	0.00688**	0.00539**	
			(0.00869)	(0.0177)	(0.00581)	(0.00295)	(0.00352)	(0.00267)	(0.00265)	
Indicator variable			− 0.00665	0.0104	− 0.0489	− 0.0250				
			(0.0386)	(0.0225)	(0.0348)	(0.0267)				
RYCS (at birth) × indicator variable			− 0.0660**	− 0.0131	− 0.0320	0.0173				
			(0.0302)	(0.0213)	(0.0347)	(0.0361)				
RYCS (at birth) × unemployment (changes) × indicator variable			− 0.0213**	− 0.0330*	0.00408	− 0.0508**				
			(0.00878)	(0.0175)	(0.0104)	(0.0237)				
Lagged dependent variable							− 0.116***	− 0.0688***	− 0.103***	
							(0.0319)	(0.0210)	(0.0354)	

Table 3 (continued)

Dependent variable: insurrection onset	Labor-market regulation		Heterogeneous effects				Dynamic specifications			Logit
			Indicator variable for							
	Heritage	Fraser	Democracy	Years of schooling	Tertiary schooling	Resource rents	FELS	LSDVC	GMM	AMEs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Year FE & region-specific trends	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	N	N	Y	Y	Y	Y	Y	Y	Y	N
Region FE	Y	Y	N	N	N	N	N	N	N	Y
Baseline controls	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
Excluded instruments	–	–	–	–	–	–	–	–	30	–
Hansen J (p value)	–	–	–	–	–	–	–	–	0.866	–
AR(2) (p value)	–	–	–	–	–	–	–	–	0.564	–
Number of countries	130	116	131	100	100	130	139	139	141	133
Observations	2074	1841	1860	1225	1225	2032	2484	2479	2644	2107

Standard errors are clustered at the country level (except for the logit regression) and reported in parentheses. All time-varying explanatory variables are lagged by 1 year. The included baseline controls are those from model (4) in Table 2. The dependent variable in models (7)–(9) is coded one for all conflict onsets in the sample and zero for all other country-years. In all other models, the baseline definition of conflict onset is used that excludes all observations with ongoing conflicts. In models (1) and (2), an indicator variable for labor regulation is included that takes the value one if the average country score for the respective index is above the sample median. In column (3)–(6), the complete set of main effects, two-way and three-way interactions is included in each model but not all effects are reported. *Democracy* is coded one if the political system is classified as a democracy, and zero otherwise. *Years of schooling* is coded one if average years of schooling are higher than the sample median. *Tertiary schooling* is coded analogously. *Resource rents* is coded one if the rents from resources as a share of GDP exceed 30%. Arellano-Bond GMM estimates (two-step procedure) in column (9) generated with small sample adjustment for standard errors and collapsed IV matrix. Exogeneity is assumed for *RYCS* (at birth), time dummies and region-year fixed effects. Endogenous variables are instrumented by two lags. The null hypothesis of Hansen's test is the joint exogeneity of all instruments. The null hypothesis of the AR(2) test is no second order autocorrelation in the errors

FELS fixed-effects least-squares, *LSDVC* corrected least-squares dummy-variable estimator (bootstrapped standard errors reported), *GMM* generalized methods of moments, *AMEs* average marginal effects, *RYCS* relative youth cohort size, standardized

Significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

minimum wage laws, dismissal regulations and centralized wage setting.[16] Since the index data are not available for the whole sample period and exhibits little variation over time, we are mainly interested in the cross-country heterogeneity regarding potential labor-market rigidities. To that end, we construct a time-invariant dummy that takes the value one if the average country score is greater than the median among countries in the sample.[17] Thus, the coefficient of *RYCS* (at birth) in columns (1) and (2) of Table 3 can be interpreted as the effect of an increase in the youth-bulge ratio in countries with below-median qualities of labor regulations, while the sum of this coefficient and the interaction effect indicates the youth-bulge effect in countries with above-median institutional quality. In line with our baseline results, we find a positive and significant correlation of the youth-bulge ratio and the likelihood of a conflict onset for countries with below-median values of regulatory quality for both indicators. In contrast, the effect is substantially smaller in countries with above-median institutional quality, as indicated by the negative and significant point estimate of the interaction term. In fact, the sum of both coefficients is close to zero and not statistically significant in both regressions. The results show that, apart from cyclical changes in unemployment, institutional bottlenecks imposed on the youth indeed aggravate the conflict potential inherent in the demographic phenomenon of a youth bulge.

The results presented so far might hide substantial heterogeneity with regard to the conflict potential of large youth cohorts in different institutional settings. The interplay of demographic pressures and labor-market conditions might be moderated by additional factors that shape the overall institutional context and therefore the income opportunities of different population cohorts. One important factor is the political system. In autocratic regimes, institutionalized channels for expressing political discontent, such as in elections, do not exist, and even when they do, they do not function as a means of policy change (Boix and Svolik 2013). For this reason, a market for insurrection activities is more likely to arise in those systems (Shadmehr and Haschke 2016). In contrast, youth bulges are less of a threat to state authorities in democracies that provide mechanisms other than repression, such as political participation and non-violent civil resistance, to respond to demographic pressures (Stephan and Chenoweth 2008; Nordås and Davenport 2013). Also, political outcomes in democracies tend to be more distributive, which might facilitate the provision of social benefits to economically disadvantaged groups.

To investigate whether the interaction of youth bulges and unemployment depends on the political system, we include a three-way interaction effect of *RYCS* (at birth), unemployment and a democracy dummy in our model.[18] We rely on the dichotomous regime classification of Cheibub et al. (2010), who define a democratic system according to the

[16] One could question the extent to which the absence of regulatory constraints actually reflects functioning labor markets. While this might be true for many (though not all) developed countries, in less developed countries the absence of labor regulations could simply reflect the failure of the state to establish a regulatory framework needed for functioning markets in the first place. That is one more reason why we refrain from using these indices as our main labor-market indicators.

[17] Since the indicator variable does not vary over time and the relative youth cohort size exhibits only little within-country variation, we refrain from including country fixed effects in our model, but instead enter regional and region-year fixed effects.

[18] In models (3)–(6) of Table 3, we separately include dummy variables for the political system, levels of education and resource rents. For ease of exposition, we summarize the coefficients on the main effects of these variables in one line, and we do the same for the interaction with *RYCS* (at birth) and the three-way interaction effect, using as a placeholder the term "indicator variable".

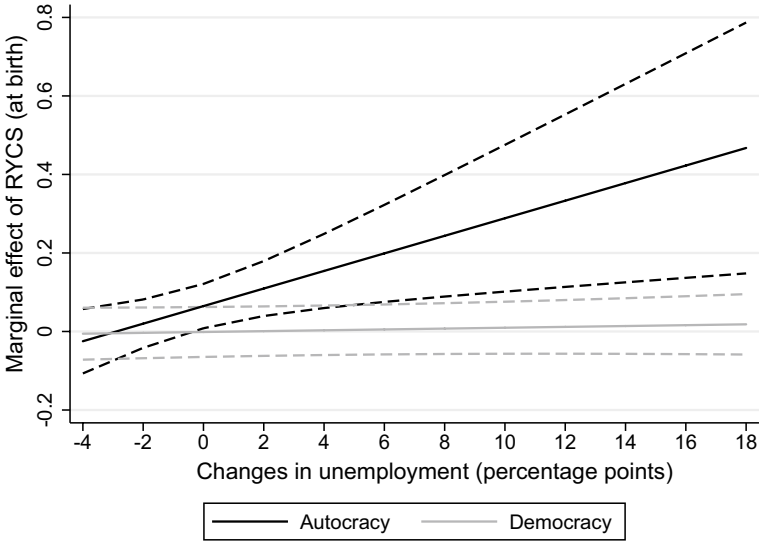

Fig. 4 Marginal effects of *RYCS* (at birth) in democratic and autocratic countries. *Note* The marginal effects are estimated for model (3) of Table 3. The dotted lines indicate the 90% confidence interval

presence of free and contested elections.[19] The positive interaction effect of *RYCS* (at birth) and unemployment in column (3) of Table 3 indicates that higher unemployment aggravates the conflict potential of a youth bulge in autocratic countries (i.e., when *democracy* = 0). In democracies, this effect is substantially smaller, as indicated by the negative three-way interaction effect.[20] Figure 4 shows the marginal effects of *RYCS* (at birth) in the two different political regimes. In democratic countries, the marginal effect is not statistically distinguishable from zero and does not depend on changes in labor-market conditions. In contrast, in autocracies the marginal effect of the youth-bulge ratio increases significantly with rising unemployment and is much more pronounced than our baseline effect, where we did not differentiate between political systems. The results thus support the idea that autocracies impose institutional constraints on the youth that are very different from those imposed in democratic systems.

Another mediating factor that has been emphasized in the relationship between youth bulges and conflict is education. In general, it is argued that higher levels of education raise income opportunities for young people (Barakat and Urdal 2009). However, rapid expansions in access to higher education potentially could produce a large group of highly educated young people that the labor market is unable to absorb, resulting in worse income prospects for graduates (Urdal 2006; Campante and Chor 2012). To test the role of education, we construct two dummy variables that indicate whether average years of schooling

[19] The results are qualitatively similar if we use the PolityIV definition and define as democratic all country-years with a Polity2 score of more than five.

[20] The partial effects of an increase in *RYCS* for a given value of *UE* in autocracies versus democracies are computed as follows. In autocracies (i.e., when democracy = 0), the effect of *RYCS* is given by $0.0647 + 0.0224 \times \overline{UE}$. When democracy = 1, the effect of *RYCS* is $0.0647 - 0.0660 + (0.0224 - 0.0213) \times \overline{UE} = -0.0013 + 0.0011 \times \overline{UE}$, which clearly is smaller than the effect in autocracies for any $\overline{UE} > 0$.

and average years of tertiary schooling are above the sample median.[21] The results in column (4) and (5) of Table 3 suggest that in countries with above-average years of schooling, the conflict potential of a youth bulge in the presence of adverse labor-market conditions is substantially lower than in countries with below-average years of schooling, as indicated by the negative and significant three-way interaction effect. In contrast, higher levels of tertiary schooling do not appear to have a significant effect on the conflict potential of a youth bulge, at least in our sample.

Finally, we test the moderating role of rents from natural resources. The coefficients in column (6) of Table 3 indicate that in countries with large shares of resource rents in GDP (more than 30%), the conflict potential of a youth bulge is significantly less than in countries with fewer rents, even in the presence of rising unemployment. This result points to an interpretation in line with the argument that governments can buy off potential youth opposition in situations where income opportunities in the economy are declining if governments exert sufficient control over the production and trading channels of natural resources.

4.4 Further robustness tests

We apply a series of further robustness tests to our baseline specification from model (4) in Table 2. In column (7) of Table 3, we model the dynamics of insurrection onsets by entering lagged values of the dependent variable.[22] The results are qualitatively unchanged from our baseline estimates, in particular with respect to the sign and magnitude of the interaction effect. The negative sign on the lagged dependent variable is intuitive as we include insurrection *onsets* that separate times of peace from those of conflict. However, employing the fixed-effects estimator in dynamic panel data models might result in the so-called Nickell bias (Nickell 1981). Therefore, we use two alternative estimation techniques to assess the reliability of our fixed-effects estimates. In column (8) of Table 3, we employ the bias-corrected least-squares dummy variable (LSDVC) estimator proposed by Kiviet (1995) and extended to unbalanced panels by Bruno (2005). In addition, we also report the results of the Arellano-Bond generalized methods of moments (GMM) estimator (Arellano and Bond 1991).[23] The estimation results are similar in size and significance to the within estimates. The GMM estimates further support the reliability of our results by including internal instruments for potentially endogenous variables. The p value of Hansen's J test of joint exogeneity suggests that the instruments are valid.

[21] The construction of the binary variables is similar to the institutional indicators in column (1) and (2) of Table 3. The only difference is that we do not construct time-invariant country averages, but use the annual observations to capture expansions in education over time. We use total years of schooling as well as years of tertiary schooling from the dataset of Barro and Lee (2013). To control for endogeneity concerns and since the data are available only for 5-year periods, we lag the variable by 5 years following Campante and Chor (2012).

[22] Excluding all observations of ongoing conflicts produces a somewhat artificial correlation between current and lagged values of the dependent variable. Therefore, in the dynamic specifications, the dependent variable is coded one for all conflict onsets, while country-years of ongoing conflicts are coded zero, following the coding procedure of Fearon and Laitin (2003). We call this variable "any conflict onset". In the online appendix, we provide a list of included cases for all conflict definitions.

[23] We employ the first-difference GMM estimator instead of the system GMM estimator because it involves fewer internal instruments. As instruments, we use lagged levels of the dependent variable, unemployment (changes) and their interaction with the youth bulge, assuming exogeneity for *RYCS* (at birth). The results do not change when entering internal instruments for this variable as well.

We also account for the fact that our dependent variable is a dichotomous conflict indicator by applying non-linear estimation techniques. Since the coefficient of the interaction effect cannot be interpreted in a meaningful way in logit regressions (Ai and Norton 2003), we show average marginal effects (AMEs) for our baseline model in column (10) of Table 3. The positive and significant AMEs support our results from the linear specification. For a given labor-market situation, larger youth-bulge ratios are, on average, associated with a higher probability of a violent conflict onset.[24]

Overall, the empirical findings support our theoretical expectation that it is not the demographic structure on its own that raises the incidence of insurrections but whether large youth cohorts are confronted with a decline in employment prospects in the official labor market. Whereas the youth bulge is significant in some, but not all regressions, we find a significant and robust interaction effect of the youth bulge and tighter labor-market constraints on the likelihood of a violent conflict onset. In other words, negative labor-market shocks seem to be most harmful to the working prospects of young men, inducing them to reallocate time away from the official labor market and toward insurrections.

5 Conclusions

This paper provides a theoretical and empirical analysis of how the interplay of a youth bulge and labor-market restrictions influences the risk of insurrection activities. We have developed a theoretical model of insurrection markets and integrated the relative youth cohort size as a measure of the youth bulge. Moreover, we have tested the empirical implications of our theory on a sample of 135 countries in the post-Cold War period. Our empirical model confirms the hypothesized causality between, on the one hand, a binding labor-market constraint in interaction with a youth bulge, and, on the other hand, the probability of an insurrection onset at the aggregate country level.

Our central finding implies that whether or not a youth bulge actually translates into outbreaks of political violence at an aggregate scale depends on the surrounding politico-economic institutions. In brief, labor-market institutions that exhibit a closed-shop character promote the supply of insurrection activists who may easily be hired by revolutionary entrepreneurs. In contrast, open-access labor-market institutions offering attractive opportunities for young people tend to reduce such a potential.

Measuring labor-market restrictions by changes in unemployment, we find strong and robust evidence for the moderating role of labor-market conditions on the conflict potential of a youth bulge. We provide a measure of youth bulges that is robust to reverse causality running from contemporaneous conflicts to demographic structures, and we show that the differential effect of tighter labor-market constraints in countries with large youth bulges is unlikely to arise through channels other than the institutional bottlenecks they impose on the youth.

Our approach aims to deepen our understanding of the relationship between demography, access to career opportunities, and conflicts. In that regard, the demographic structure of the contemporary Arab world may turn out to be much more relevant for explaining the violent contemporary conflicts than the religious cleavages that appear on the surface. Our model is in line with such an explanation, and it suggests that the structural causes of civil conflict need to be disentangled more thoroughly.

[24] In the online appendix we provide additional robustness tests to our baseline model. In particular, we show that our results are robust to alternative definitions of the dependent variable and the youth cohort, as well as to different time structures and to the inclusion of additional demographic controls.

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Appendix

The revolutionary elite's maximization problem

Considering Eq. (4) in combination with Eq. (2), the maximization problem of the revolutionary elite is:

$$\mathfrak{J} = t^R \beta I - \rho\, w_I I + \lambda(\tau^R Y - t^R).$$

The Kuhn–Tucker conditions are then:

$$\mathfrak{J}_I = t^R \beta - \rho\, w_I \leqslant 0; \tag{A.1}$$

$$\mathfrak{J}_{t^R} = \beta I - \lambda \leqslant 0; \tag{A.2}$$

$$\mathfrak{J}_\lambda = \tau^R Y - t^R \geqslant 0; \tag{A.3}$$

$$I, t^R, \lambda \geqslant 0; \tag{A.4}$$

$$I\mathfrak{J}_I = I(t^R \beta - \rho\, w_I) = 0; \tag{A.5}$$

$$t^R \mathfrak{J}_{t^R} = t^R(\beta I - \lambda) = 0; \tag{A.6}$$

$$\lambda \mathfrak{J}_\lambda = \lambda(\tau^R Y - t^R) = 0. \tag{A.7}$$

The citizens' maximization problem

The citizens maximize (6) subject to their time restriction $l + i \leq 1$ and subject to the labor-market restriction $l \leq \varepsilon$. The Lagrangian is as follows:

$$\mathfrak{J} = (1 - t^G A^G) w_L l + \rho((1 + w_I)^{r\mu} - 1) i + \lambda_1(1 - l - i) + \lambda_2(\varepsilon - l). \tag{A.8}$$

The Kuhn–Tucker conditions of the citizens' maximization problem are:

$$\mathfrak{J}_l = (1 - t^G A^G) w_L - \lambda_1 - \lambda_2 \leqslant 0; \tag{A.9}$$

$$\mathfrak{J}_i = \rho((1 + w_I)^{r\mu} - 1) - \lambda_1 \leqslant 0; \tag{A.10}$$

$$\mathfrak{J}_{\lambda_1} = 1 - l - i \geqslant 0; \tag{A.11}$$

$$\mathfrak{J}_{\lambda_2} = \varepsilon - l \geqslant 0; \tag{A.12}$$

$$l > 0; \quad i, \lambda_1, \lambda_2 \geqslant 0; \tag{A.13}$$

$$l\mathfrak{J}_l = l((1 - t^G A^G) w_L - \lambda_1 - \lambda_2) = 0; \tag{A.14}$$

$$i\mathfrak{J}_i = i(\rho((1 + w_I)^{r\mu} - 1) - \lambda_1) = 0; \tag{A.15}$$

$$\lambda_1 \mathfrak{T}_{\lambda_1} = \lambda_1(1 - l - i) = 0; \tag{A.16}$$

$$\lambda_2 \mathfrak{T}_{\lambda_2} = \lambda_2(\varepsilon - l) = 0; \ \textit{hence} : \ \lambda_2 \mathfrak{T}_{\lambda_2} = \lambda_2(\varepsilon N - N) = 0. \tag{A.17}$$

If both restrictions in (A.8) were non-binding, so that $\lambda_1 = \lambda_2 = 0$, then this would imply by Eq. (A.14) that either $w_L = 0$ or $l = 0$ since both are non-negative. Note, however, that $l = 0$ is ruled out by the *Inada* conditions for the production function, while $w_L = 0$ is ruled out by both the *Inada* conditions and by $\delta r^{-1} > 0$ in combination with the firm's first-order maximization condition (7); this is at least true as long as the effective tax rate is not fully confiscatory, i.e., as long as $t^G A^G < 1$. A non-binding time restriction of the citizens (i.e., $l + i < 1$ and hence $\lambda_1 = 0$) is nevertheless possible, but that presupposes the labor-market imperfection to induce a binding constraint, so that $\lambda_2 > 0$. Both restrictions being non-binding, however, is not possible as long as $t^G A^G < 1$.

Given $\lambda_2 > 0$, however, a non-binding time constraint of the citizens remains possible, but this would, by Eq. (A.15), be associated with either $i = 0$, or with $\rho((1 + w_I)^{r\mu} - 1) = 0$, or both. The implication is this: Should $\lambda_2 > 0$, so that the citizens are rationed in their labor-market supply, and should the marginal utility from insurrection activities $\rho((1 + w_I)^{r\mu} - 1)$ be zero, then the citizens are unable to fully employ their disposable time for income generation: On the market for insurrection, they have no incentive for being active because of $\rho((1 + w_I)^{r\mu} - 1) = 0$; and on the labor market, they would want to be active to the full extent of their time devoted for income-generating activities, but they cannot do so because of the positive chance $\varepsilon > 0$ of being unemployed.

Finally, combinations of $\lambda_1 > 0$ with $\lambda_2 = 0$ or with $\lambda_2 > 0$ are also possible. In the former case, the labor market clears, whereas in the latter case, all unemployed labor-market time will be supplied to the revolutionary elite.

Analyses of cases A and B

Case A: $\lambda_1 = 0$; $\lambda_2 > 0$.

From Eq. (A.14) and from $\lambda_1 = 0$, we have $l((1 - t^G A^G) w_L - \lambda_2) = 0$. Since the *Inada* conditions of the production function $F(\delta r^{-1} L, A)$ rule out $L = lN = 0$, we have $(1 - t^G A^G) w_L = \lambda_2 > 0$. The non-negativity of $\rho((1 + w_I)^{r\mu} - 1)$ in combination with Eq. (A.10) implies $\rho((1 + w_I)^{r\mu} - 1) = 0$ because of $\lambda_1 = 0$. Substituting the compensation rates w_L and w_I by the marginal productivities from (7) and (8), and considering the labor-market restriction in (A.17) as well as the assumption of case A that $\lambda_2 > 0$, the equilibrium in case A is:

$$\begin{aligned} &(1 - t^G A^G)\delta r^{-1} F'(L) - \lambda_2 = \rho((1 + t^R \beta \rho^{-1})^{r\mu} - 1) = 0; \\ &\text{and } (1 - t^G A^G)\delta r^{-1} F'(L) = \lambda_2 > 0. \end{aligned} \tag{A.18}$$

Note that, because of $\lambda_2 > 0$, employment L in equilibrium is lower than N and the wage rate in equilibrium $w_L = \delta r^{-1} F'$ is higher than its market-clearing value. We define the latter as $w_L^e = w_L(L = N)$.

Case B: $\lambda_1 > 0$; $\lambda_2 \geqslant 0$.

Case B is characterized by:

$$(1 - t^G A^G)\delta r^{-1} F'(L) - \lambda_2 = \rho((1 + t^R \beta \rho^{-1})^{r\mu} - 1) \tag{A.19}$$

which, according to (A.15), is associated with $i \geq 0$.

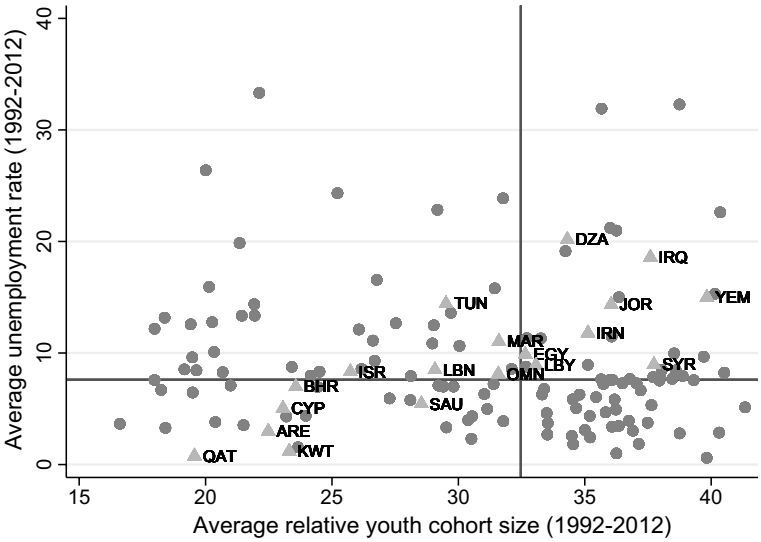

Fig. 5 Unemployment rates against youth bulges in MENA countries. *Note* Scatter plot for 135 non-OECD countries. MENA countries are labeled by triangle markers and their country names, while all other countries are indicated by circular markers. The y-axis plots the unemployment rate in the total labor force, averaged over 1992–2012. The x-axis plots the relative youth cohort size [measured as the ratio of the male youth cohort (aged 15–24 years) relative to the economically active population (ages 15–69)], averaged over 1992–2012. The vertical and horizontal lines indicate the median values of the x- and y-axis variables

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