Refuge and Refugee Migration: How Much of a Pull Factor Are Recognition Rates?

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Abstract

Asylum policies can be interdependent across countries: Policy choices in one country can affect refugee flows into neighbouring countries and may provoke policy changes there. Such strategic interactions between destinations pose a challenge to the estimation of the effect of asylum recognition rates on the number of arriving refugees. To account for this, we calibrate a dynamic model of refugees' location choices and of the strategic interaction among destinations. We find an elasticity of asylum applications in Europe with respect to annual recognition rates of 0.3-0.4 for Syrian refugees, and that recognition rates are strategic substitutes at the equilibrium. We relate our approach to more conventional ones that rely on cross-country variation.

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1 Introduction

EU countries have varied considerably in their openness to refugees. Some member states accuse others of exacerbating refugee flows into the EU through generous acceptance policies. In this paper we evaluate the effect asylum recognition rates have on refugee numbers. While previous literature has tried to estimate this effect based on cross-country variation, spillovers between destination countries and the resulting strategic interdependence of policy choices may bias regression results of that type. We choose an approach that is new to the political economy literature on migration and that allows us to explicitly account for a potential strategic element in destination countries' asylum policies. To this end, we formulate a dynamic life cycle model of refugee migration, in which individuals can move to different destinations. We interpret observed asylum policies as an equilibrium outcome, which allows the model to be used for predictions of countries' best responses in setting their optimal policies. Calibrating the model to match observed numbers of Syrian refugees provides insights into the effects of policy choices on refugee flows in general, and into the nature of externalities among EU countries in particular.

A strategic interdependence arises among countries in close geographic proximity if the acceptance rate in one destination affects applications in other countries of asylum as well. For instance, knowing that recognition rates are high in Sweden will affect the number of refugees in Denmark. The direction of this effect is a priori unclear. On the one hand refugee flows would be diverted from Denmark to Sweden. On the other hand, the overall number of refugees arriving in Europe may be higher, with a positive effect also on the number of refugees settling in or passing through Denmark. This generates an interdependence across observations (countries), which can bias estimates of the effect of a change in the recognition rate in an unknown direction. In the spirit of Bulow et al. (1985), we label recognition rates as strategic substitutes if an increase in the rate of one country causes a tightening of policy elsewhere. On the other hand, we speak of strategic complements if a policy change in one country provokes policy changes in the same direction in other countries. We show that if recognition rates are strategic substitutes, then the bias in regression estimates obtained from a cross-country dataset can be signed. On the other hand, if they are strategic complements, the direction of bias is ambiguous. The structural approach allows us to explicitly account for spillovers and to determine the strategic nature of recognition rates. In particular, we do not impose any shape restriction on best response functions, which in general can even be non-monotonic. Our calibrated model suggests that among European destinations recognition rates are strategic substitutes at the equilibrium.

Another advantage of our approach is that we do not have to utilise information from multiple countries of origin. The particularities of different conflicts and causes of forced migration leave it unclear to what extent observed differences across countries of origin should be used at all to predict the effect on a specific refugee population, such as the Syrian one to which we apply our model. Beside the challenge of controlling for various contextual differences across origins, the high recognition rate for Syrian refugees in particular would require an extrapolation to the far end of the distribution of recognition rates. Figure 1 shows the distribution of acceptance rates (conditional on a decision being made) for refugees from major countries of origin. The figure illustrates the high rate at which asylum applications by Syrians are accepted, which is only shared by a few other major refugee populations like those from the Central African Republic and Eritrea. Due to this difference compared to most other origin countries, we choose to calibrate the model using information on Syrian refugees only.

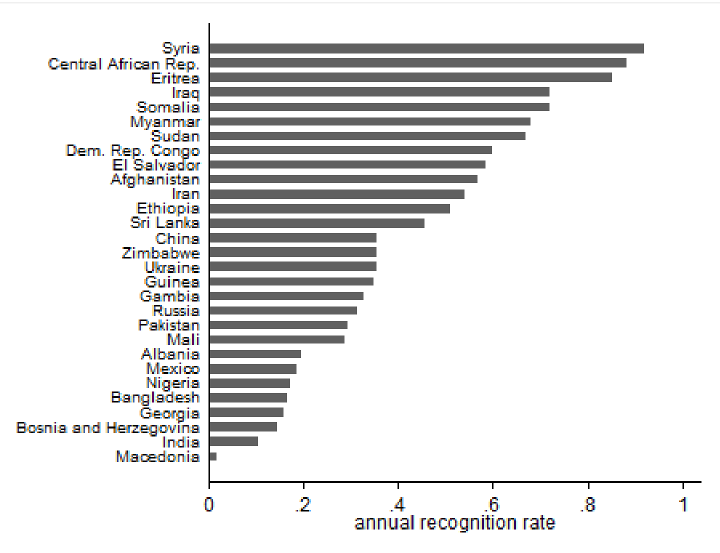

Figure 1: Recognition rates among asylum applications processed in 2014 across countries of origin from which at least 10,000 applications have been filed (worldwide).
Source: UNHCR, "Statistical Yearbook 2014".

The calibrated parameters tell a plausible story about the choices faced by Syrians: In the absence of any shocks to their personal circumstances such as armed conflict in their area of residence, Syrians would prefer to remain in their home country. While life as an accepted refugee in Europe provides a higher flow utility, acceptance is uncertain and utility experienced during each period spent in Europe while an asylum claim is being processed is by far the lowest. In addition, reaching Europe involves a cost of first moving to one of the countries surrounding Syria.

Our estimates imply an elasticity of the number of asylum applications by Syrian refugees in a given European destination with respect to annual recognition rates of 0.29-0.42, depending on the model and countries considered. Increases in the recognition rate of Syrian refugees in one group of European countries also increase the number of arrivals in other European countries. However, the effect of increased recognition rates in Northern Europe on the number of refugees arriving in South-Eastern Europe is stronger than vice versa. One reason for this asymmetry are different values that refugees attribute to living in these destinations. In particular, the estimated higher utility refugees derive from being accepted for asylum in Northern Europe implies that changes in Northern asylum policies have a stronger effect on refugee's location choices. Accordingly, increases in recognition rates in Northern Europe also provoke more pronounced policy responses in South-Eastern Europe than in the reverse case.

The policy diffusion literature describes competition effects that make a policy change spread across countries (Simmons and Elkins, 2004). In the case of immigration and asylum policies the possibility of an opposite effect exists, if increased openness in one country triggers a more restrictive policy decision by other countries. Besides theoretically formulating this hypothesis of policies as strategic substitutes– for which we indeed find empirical evidence– this paper specifically contributes to the political economy literature on refugee migrations. Several studies have examined the relation between asylum recognition rates and the number of applications, see e.g. the papers by Holzer et al. (2000), Vink and Meijerink (2003), Neumayer (2004), and Hatton (2016). While many of these papers provide a detailed descriptive account, Hatton (2009) explicitly addresses the endogeneity of destination countries' recognition rates with respect to the number of arrivals. Neither of these papers, however, takes interdependencies across countries into account. In a different strand of research, a number of studies have highlighted the interrelatedness between different host countries' migration and asylum policies. A paper that has received attention beyond academic circles is Fernández-Huertas Moraga and Rapoport (2014), who treat the acceptance of refugees as a public good and propose a system of tradable immigration quotas that matches international migrants to host countries while accounting for both migrants' and countries' preferences. Hatton and Williamson (2006), Facchini et al. (2006), Fernández-Huertas Moraga and Rapoport (2015) and Hatton (2015) more closely investigate the benefits of policy coordination for the particular case of refugee reallocation within the European Union. For the case of non-refugee migration, the interdependency of destination countries' immigration policies has been documented by Boeri et al. (2005). Bertoli and Fernndez-Huertas Moraga (2015) highlight the threat of this interrelatedness to the identification of policy effects based on cross-country variation. Finally, we also contribute to the growing literature that uses dynamic behavioural models to examine internal and international migration (see e.g. Kirdar (2012) and Llull (2017) for other applications, and Dustmann and Görlach (2016) for a broader overview of this literature).[1] We extend this approach to model refugee movements across several countries. For recent overviews of various economic aspects of refugee migrations, see e.g. Ruiz and Vargas-Silva (2013), Chin and Cortes (2015) and Dustmann et al. (2017).

Before presenting our structural model in Section 3, we put our analysis into the broader context of international refugee migration and detail our concerns regarding estimation based on cross-country variation in this setting. Section 4 explains how we identify and calibrate the model's parameters, while Section 5 presents the results and some extensions. Section 6 summarizes our findings and concludes.

2 Cross-country Comparison and Concerns

This section provides some descriptive evidence on the joint distribution of recognition rates and asylum applications, which provides a useful background for the main analysis presented subsequently. We also use this section to explain in more detail why it is difficult to derive causal estimates from cross-country data.

UNHCR provides bilateral information on the number of asylum applications and the number of positive decisions on an annual basis. In Section 4 we calibrate the model to numbers of Syrian refugees observed in 2014, since 2015 saw several major events that we do not intend to model: A food supply crisis in refugee camps in Jordan and the beginning of Russian military intervention in Syria were among the factors that contributed to the surge in the number of refugees arriving in Europe in 2015. As a result, a number of European countries successively introduced border controls and constructed physical barriers. Hence, our main source of information in this descriptive section is UNHCR's Statistical Yearbook 2014, although where lagged variables are used, these are taken from earlier editions. The yearbooks provide bilateral information on the number of pending applications at the beginning of each year, new applications during the year, as well as the number of applicants who are granted protection.[2] Even though adherence

[1]Different from ours, the models in these papers consider the choice between one origin and one destination only. Other exceptions include the models by Kennan and Walker (2011), who consider internal migration between multiple locations within the United States, and Girsberger (2015), who models both internal rural-urban and international migration from Burkina Faso.

[2]It is important to note that these bilateral Yearbook data, which also have been used in earlier studies, only include refugees who formally apply for asylum under the Geneva Convention. This is not the case for the vast majority of Syrian refugees, who enjoy group protection in the main receiving neighbouring countries, but are not granted permanent asylum under the Geneva Convention. When we focus on Syrians below, we do consider all Syrian refugees in neighbouring countries, with numbers taken from http://data.unhcr.org/syrianrefugees/regional.php. See also Section 4.

to the Geneva Refugee convention of 1951 limits the degree to which the outcome of an asylum application is a policy parameter, decisions such as the compilation of safe origin country lists or a relaxation of the EU's Dublin agreement are political choices. In particular, countries can deter refugees by a slow processing of requests for asylum. Since the fraction of asylum applications by Syrian refugees that is rejected is very low, waiting times can be directly mapped to annual acceptance rates. In what follows, as well as in the behavioural model, we thus focus on the effects of a change in destination countries' *annual* acceptance rate as the main policy parameter of interest.

To compute the number of asylum seekers relative to the size of the origin population, we augment our dataset with population sizes provided by the World Bank (2016). We further supplement the UNHCR data with bilateral geographic information collected by the Centre d'études prospectives et d'informations internationales (CEPII, see Mayer and Zignago, 2011), as well as with bilateral migrant stocks. This latter information is available only for OECD destinations[3].

Panel (a) of Figure 2 shows the log number of new applications registered by UNHCR in 2014, plotted against recognition rates. Since recognition rates are calculated as the number of accepted applications in a given year relative to the number of pending and new applications, we use lagged recognition rates in what follows to avoid having the dependent variable in the denominator of the right-hand side variable and thus a mechanical attenuation from measurement error. Also, and even though we do not view the patterns described in the section as causal, we want to limit reverse causality, i.e. the degree to which acceptance rates react to the number of applications by refugees from particular origin countries. The figure shows a clear positive correlation between recognition rates and new applications.

The migration literature has long documented that economic migrants tend to choose destinations with existing communities of earlier migrants from the same origin (see, for instance, Bauer and Zimmermann, 1997; Munshi, 2003; McKenzie and Rapoport, 2007, 2010), and this likely applies to refugees as well. Panel (b) of Figure 2 thus controls for the pre-existing stock of migrants from the same origin. The association between our variables of interest also remains strong and positive after including additional bilateral controls[4] (Panel (c)) and a full set of origin and destination indicators (Panel (d)). Magnitudes are also robust to using recognition rates two periods back.

After reducing omitted variable bias via the inclusion of controls, the estimated coefficient obtained implies that a one percentage *point* increase in the probability of being accepted for asylum is associated with a rise in the number of applications by about 1.3

[3]The stock of foreign nationals was retrieved from http://stats.oecd.org on 08.12.2016.

[4]These are a bilateral indicator for whether two countries have a common border, the bilateral distance between countries, and indicators for whether two countries share an official or an ethnic language.

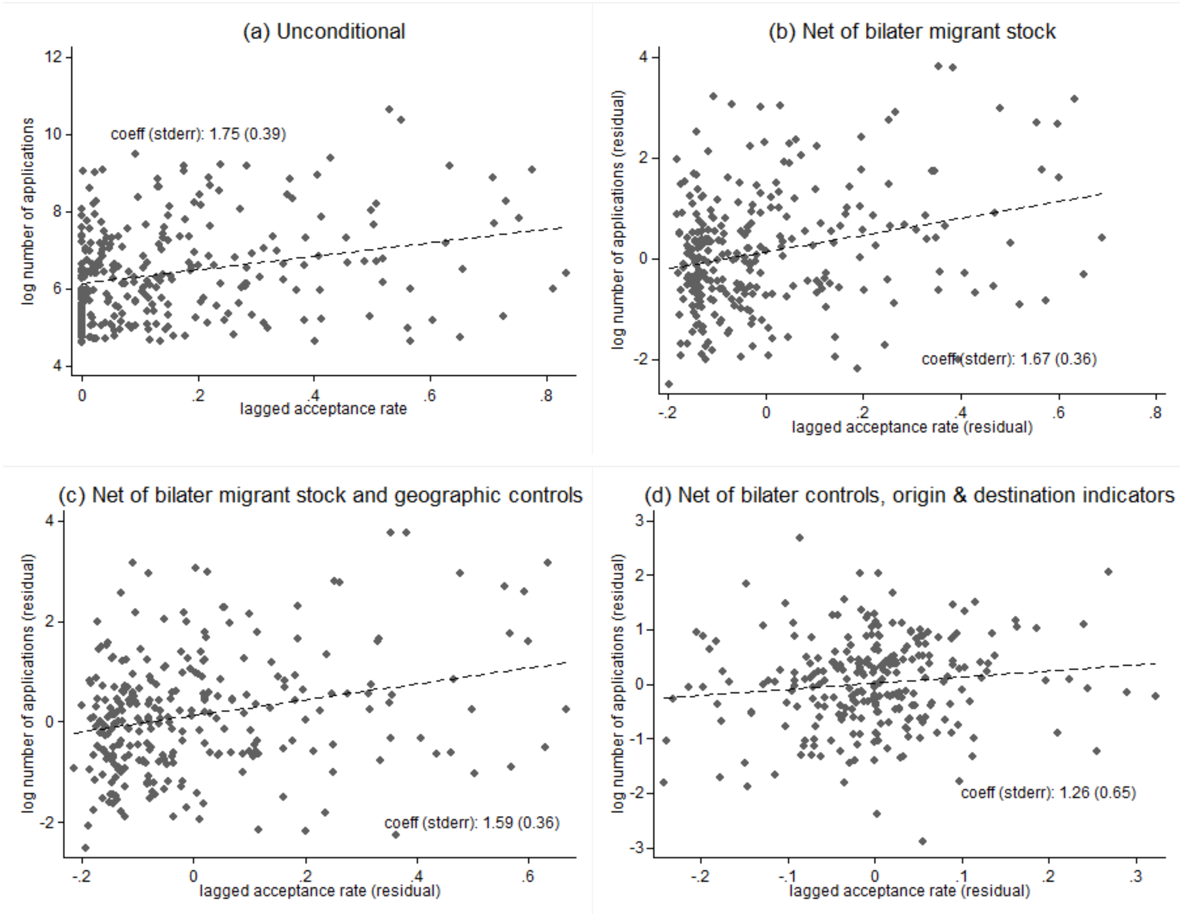

Figure 2: Asylum applications and (lagged) recognition rates in 2014. Source: UNHCR Statistical Yearbook 2014, Mayer and Zignago (2011), OECD and World Bank (2016).

percent.[5] Given that the average recognition rate is 15.6 percent, this corresponds to a non-causal elasticity of 0.2. One reason why we do *not* interpret this number as the causal relation between recognition rates and asylum application is that spillovers and strategic interaction between different host countries may create a dependence between observations that renders regression analysis on our sample (including the use of instrumental variables) invalid.

Independence of observations is often taken for granted. In our context, however, it is violated if one destination's asylum policy affects not only the number of refugees applying there, but also the number seeking asylum in other destinations. This very likely is the case, especially for destinations as geographically close as member countries of the European Union. Thus, a high recognition rate in Austria, Germany or Sweden will also affect the number of refugees arriving in Greece, Hungary or Italy. This interrelatedness

[5]This is in fact similar to the semi-elasticities estimated by Hatton (2009), who also uses UNHCR data, though for a period before the Syrian crisis. His IV estimates are in the range of 1.2-1.6.

further provides scope for strategic policy choices across different destinations.[6]

To fix ideas, note that an increase in one destination's acceptance rate has two competing effects on other destinations. On the one hand, it diverts refugee flows from other European countries. On the other hand, it potentially induces more individuals to move to Europe in the first place, some of whom potentially end up in different countries. Depending on which effect dominates, other destinations may respond by raising or lowering their own acceptance of asylum applications. Hence, it is a priori unclear whether asylum policies are strategic complements or substitutes. The overall effect on application numbers, however, will depend on this. The model presented in the next section thus does not impose the strength or direction of strategic effects. Instead, we let the data—via the calibrated model—determine the strategic nature of policies, both in and out of equilibrium. A more detailed discussion that explicitly relates our approach to regression-type estimators is provided in Appendix C, where we also provide a more detailed account of the conditions under which spillovers and strategic interaction require an equilibrium model.

A further concern arising is that the slopes in Figure 2 mask considerable heterogeneity across different refugee populations. To get a better sense for how Syrians compare to asylum seekers from other origins, Figure 3 selects the five origin countries for which the UNHCR data contains the largest number of destinations with a positive number of applications in 2014. Panel (a) shows the number of applicants as a share of the origin population (on a log-scale) against lagged recognition rates. For each of these countries—Afghanistan, Iraq, Pakistan, Somalia and Syria—we observe a similar number of entries, ranging from 29 for Pakistan to 35 for Syria. Relative to its population size, Pakistan originates the lowest number of refugees among these five countries, and asylum seekers from Pakistan have the lowest chance of being accepted (8.9 percent on average). Relative refugee numbers are higher for the other countries, especially for Somalia and Syria, whose citizens are also more likely to be accepted for asylum across a number of destinations.

To facilitate a comparison between different origins, we add a fitted line for each of the five countries to Figure 3. Again, these patterns are not informative about a causal relation between recognition rates and asylum applications. We do, however, interpret them as suggestive evidence for important differences across contexts in which refugee migrations happen. For two of these countries (Afghanistan and Somalia), the

[6] To calibrate the model, we divide European countries in two groups (South-Eastern versus Northern and Western Europe, see Section 4 for details). Based on Eurostat data for the years 2008-2016, the correlation in annual recognition rates between these groups is -0.56. While this negative correlation suggests that recognition rates may be strategic substitutes in this particular case, a clear interpretation requires the specification of some underlying model, as we do below.

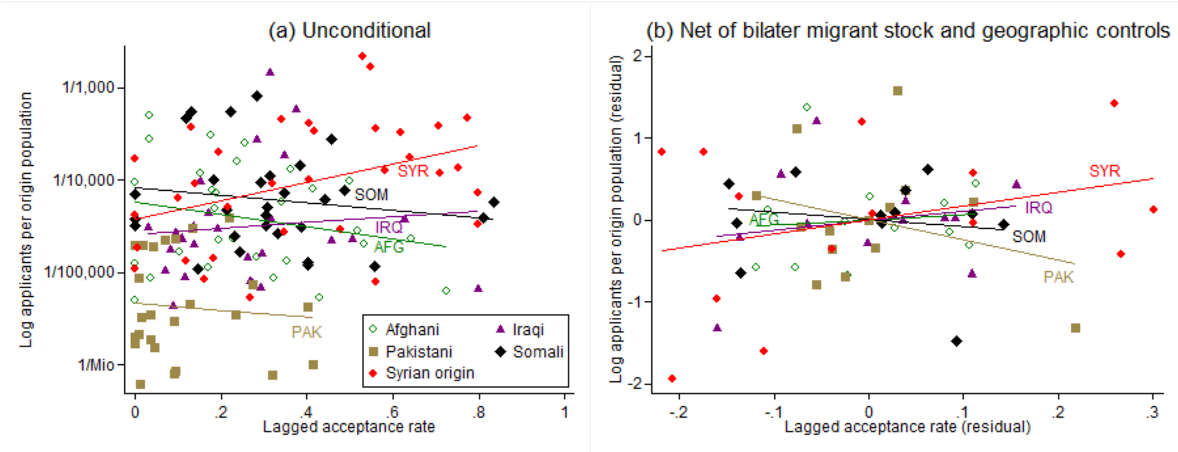

Figure 3: Applicants per origin population for selected countries by recognition rates, (a) unconditional, and (b) conditional on the pre-existing stock of migrants from the same origin, a bilateral indicator for whether two countries have a common border, the bilateral distance between countries, and indicators for whether two countries share an official or an ethnic language. Source: UNHCR Statistical Yearbook 2014.

correlation is in fact consistently negative, while it is largest for refugees from Syria. This heterogeneity in slopes is preserved in Figure 3(b), where we plot the residuals net of the same bilateral controls used in Figure 2(c).

The kind of cross-country regression analysis presented above requires that data from many origins, destinations and possibly time periods is used in order to achieve a sufficiently large sample size. This necessarily implies that one draws conclusions about the behaviour of Syrian refugees from that of refugees from El Salvador, Eritrea, Myanmar, Ukraine and many other countries. Similar sources of variation have been used extensively in a variety of areas of empirical economic research, and we agree that it is a valid tool in many cases to gain generalizable insights into economic phenomena. In our particular context of international refugees, who flee due to very different political and social circumstances and seek asylum in very different kinds of destination countries, however, we would like to raise a note of caution. This is a further motive for the more structural approach taken below, which allows us to use data on Syrian refugees only.

3 A Model of Refugee Migration

In order to avoid the concerns raised above, we formulate a dynamic model of refugees' location choices, where one destination's asylum acceptance rate may divert or enhance refugee flows. The model is tailored closely to the case of Syrian refugee migration, and we calibrate it to data on Syrian refugees only, avoiding the uncomfortable need to draw conclusions based on refugees from very different contexts. Our argument that strategic interdependencies across destinations need to be accounted for, however, carries over to other cases, and the model can be adjusted to apply to different contexts of forced migration.

The model has two layers with separate sets of decision makers. The “inner” part models individual refugees moving across locations. Their choices are determined by stochastic shocks, different flow utilities received in different locations and by whether a refugee is accepted for asylum. We assume that acceptance probabilities are known and taken as given by the individuals. The “outer” part of the model acknowledges that these acceptance rates are a choice of destination countries, which affects refugee flows and may trigger adjustments in other destinations’ policies. We describe these two parts of the model in turn.

3.1 The Refugee’s Location Problem

Almost one quarter of the Syrian population now lives as international refugees outside the Syrian borders. Like in many other contexts of forced displacement, most of these refugees reside in a number of neighbouring countries, while some have moved on to other destinations, primarily to member countries of the European Union.[7] In our model, individuals thus can choose between their home country, a neighbouring country that accepts all arriving refugees, and two potentially more attractive destinations, D_1 and D_2, where entry and asylum are more tightly restricted. According to the Dublin agreement, refugees can only apply for asylum in the first EU country they enter, but in practice not all countries enforce this rule. In line with this we assume that while refugees may pass through one of these locations (D_1) and still apply for asylum in the other destination (D_2), this is not the case for migration in the opposite direction. For instance, a refugee can pass through Hungary and still be granted asylum in Austria, while the Hungarian authorities would deny asylum to refugees coming from Austria.[8] In addition, leaving either destination country while an asylum application is being processed means that the individual in questions will not be able to apply for asylum again in this country in the future. None of the assumptions for this exact setup is required for identification. However, we do need to specify the choice set available to agents in each state and consider this a good representation of the situation faced by Syrian refugees.

[7] In addition, between six and seven million Syrians have been displaced internally. As this paper is concerned with asylum recognition rates, however, we focus on international refugees.

[8] In some cases, deportations of refugees have been legally ruled out. In particular, deportations from other EU countries to Greece have been declared unlawful by the European Court of Human Rights already in 2011 (European Court of Human Rights, 21 January 2011). To see the implications of our assumption more clearly, we discuss results obtained from a symmetric version of the model in Section 5.3.

At the beginning of each period t an individual i decides on a location l_{it} with the choice set depending on his or her current location. We label these locations as source country S, transition country T, and destinations D_1 and D_2. Choices further depend on the agent's current age, age_{it}, his or her age at the outbreak of the conflict, age_i^c, and when in either D_1 or D_2 on refugee status $r_{it-1} \in \{n(ot\ accepted), a(ccepted)\}$ in the previous period. In addition, given that destination D_1 is assumed to enforce the Dublin agreement vis-à-vis refugees coming from D_2, and D_2 rejects all applicants who have temporarily left or have been accepted for asylum in D_1, we keep track of the option that asylum may still be granted in D_1 and D_2 respectively. We denote the corresponding two-dimensional state variable by $\mathbf{o}_{it} \in \{(1,1);(0,1);(0;0)\}$, where the first (second) element of $\mathbf{o}_{it}$ equals 1 if the person can still be accepted in D_1 (D_2) and equals zero otherwise. The vector $\Omega_{it} = (age_{it}, age_i^c, l_{it-1}, r_{it-1}, \mathbf{o}_{it})$ collects these state variables. In what follows we suppress the dependence of all choices on this state vector and use the easier notation $V_{l,r_o} \equiv V(age_{it}, age_i^c, l_{it-1} = l, r_{it-1} = r, \mathbf{o}_{it} = \boldsymbol{o})$ for an individual's value given the respective states. For instance, $V_{D_2,n_{(0,1)}}$ denotes the value for a refugee who has arrived in D_2 and has not yet been accepted for asylum, but has the option of being accepted in D_2, while he or she will not be accepted in D_1 anymore.

In many contexts of armed conflict, most displaced individuals only have the immediate option to escape to a nearby country. We thus assume that when in the source country, an individual only has the choice between staying or moving to a neighbouring country T, so that the individual's maximised value is

$$\widetilde{V}_{S,n_o} = \max\{V_{S,n_o}, V_{T,n_o}\}.$$

When in country T, the individual has the choice between staying there for at least one more period, returning to S or migrating on to one of two more attractive destinations. In the latter case, the individual arrives as a not yet accepted asylum seeker, so that for a refugee in T,

$$\widetilde{V}_{T,n_o} = \max\{V_{S,n_o}, V_{T,n_o}, V_{D_1,n_o}, V_{D_2,n_o}\}.$$

In the data, we observe asylum applications in the different destinations rather than the number of people passing through. Thus, a direct move from T to D_2 in the model corresponds to passing through D_1 without registration as an asylum seeker. This was the case for the majority of refugees applying for asylum in a Northern European destination.

Once at destination $D_d, d \in \{1,2\}$, in each period the individual will be accepted for asylum with probability p_d if he or she (1) has not been accepted for asylum previously, (2) has never left destination D_d, and (3) if in destination D_1, has never been to D_2.

Regardless of legal status, the individual may each period decide to either stay for at least one more period, to move to the respectively other destination country or to return to T. The maximised continuation values in D_d are thus

$$\begin{aligned}
\widetilde{V}_{D_1,n_{(1,1)}} &= \max\{V_{T,n_{(0,0)}}, p_1 V_{D_1,a} + (1-p_1)V_{D_1,n_{(1,1)}}, V_{D_2,n_{(0,1)}}\} \\
&\qquad \text{if not yet, but with option of being accepted in } D_1 \text{ or } D_2 \\
\widetilde{V}_{D_2,n_{(0,1)}} &= \max\{V_{T,n_{(0,0)}}, V_{D_1,n_{(0,0)}}, p_2 V_{D_2,a} + (1-p_2)V_{D_2,n_{(0,1)}}\} \\
&\qquad \text{if not yet, but with option of being accepted in } D_2 \\
\widetilde{V}_{D_d,n_{(0,0)}} &= \max\{V_{T,n_{(0,0)}}, V_{D_d,n_{(0,0)}}, V_{D_{d^-},n_{(0,0)}}\} \\
&\qquad \text{if not yet and no option of being accepted in either } D_1 \text{ or } D_2 \\
\widetilde{V}_{D_d,a} &= \max\{V_{T,n_{(0,0)}}, V_{D_d,a}, V_{D_{d^-},n_{(0,0)}}\} \qquad \text{if accepted for asylum,} \qquad (1)
\end{aligned}$$

where D_{d^-} denotes the respectively other destination.

The value individuals derive from being in a given location and with a given legal status depends on a large range of factors, including cultural and economic ones, many of which are unobservable to the econometrician. Rather than specifying a parametric utility function with assumptions about the relative importance of observed and unobserved factors, we choose to calibrate the level of flow utility for each combination of location and legal status to match observed migration patterns.[9]

We let v_{l_r} denote the location and legal-status specific utility flow in $l_r \in \{S, T, D_{1,u}, D_{1,a}, D_{2,u}, D_{2,a}\}$, and assume that for $age_{it} \geq age_i^c$ (from the start of the conflict onward) individuals face transitory shocks ε_{it}^l to their l_r-specific payoff.[10] Then, given state vector Ω_{it}, an individual's welfare is determined by current and expected future payoffs, which we assume are discounted at a rate β, so that

$$V(\Omega_{it}) = v_{l_r} + \varepsilon_{it}^l + \beta \mathrm{E}[\widetilde{V}(\Omega_{it+1})].$$

We assume that individuals live for τ periods. Our policy parameter of interest in this setting is the acceptance rate of asylum applications, p_d, which will affect both the fraction deciding to move on from the transition country, as well as the distribution of refugees across destinations D_1 and D_2.

[9] Note that in the absence of individual level data we cannot allow for individual unobserved heterogeneity or account for individual economic outcomes. Our approach with location and legal status specific flow utilities is more flexible than for instance assuming that payoffs are proportional to average earnings in each state.

[10] We specify ϵ_{it}^l to be standardized extreme value distributed with variance one to normalize the scale of utility flows. Additivity of ε_{it}^l in the utility function, independence and extreme value distribution imply that the location choice probabilities take a logistic form, with value functions in the respective location-legal status specific states as arguments, as in Rust (1987).

3.2 The Game between Destinations

Besides the group of neighbouring countries T, which accept refugees from S unconditionally, we consider two further destinations D_1 and D_2, which choose to accept only a fraction of pending asylum applications in any given period. While acceptance rates are taken as given from a refugee's perspective, they are set endogenously by these destinations in order to achieve a target number of refugees residing in the country. Governments in D_1 and D_2 anticipate refugee flows as a function of the acceptance rates they and the respectively other destination set, and thus decide strategically. Let destination d's payoff be

$$\Gamma_d(N_d) = -|s_d(p_1, p_2) - \rho_d|, \tag{2}$$

where s_d is the actual share of the Syrian population to arrive in destination d while ρ_d is the targeted share.

We consider Nash equilibria in pure strategies of the game among destinations. One feature of this game is that the number of refugees arriving in a destination is ceteris paribus monotone increasing in the rate at which this country accepts asylum applications. As a consequence, the optimal recognition rate of a country is always unique: either a country achieves its optimum at some interior recognition rate, or it chooses a recognition rate of zero (one) if the number of arriving refugees is too high (low). An observation that follows is that at any interior equilibrium of the game each destination achieves the optimal number of refugees. It also follows that the existence of at least one equilibrium in pure strategies is guaranteed,[11] albeit not the existence of an interior one. Since both destinations achieve their optimal number of asylum seekers, cooperation between destinations would not yield a preferred outcome compared to the non-cooperative equilibrium we consider.

All other characteristics of the game depend on the parameter values in the model of location choices by refugees. Acceptance rates may, for example, be strategic complements if a more generous policy in one country lowers the number of arrivals in the other destination and therefore results in a higher acceptance rate there. It is, however, equally possible that policy choices are strategic substitutes, or in fact that the externalities among destinations have opposite signs. The reason for this is that the recognition rate set by one destination has a number of competing effects on the number of arrivals in the other destination. The most direct effect is that an increase in the recognition rate set by destination d will make some individuals move to destination d who would have

[11] Best responses are continuous functions mapping from $[0, 1]$ into $[0, 1]$ and Brouwer's fixed-point theorem accordingly implies existence.

otherwise moved to destination d^-. This reduces the number of arrivals in d^-. However, a more generous asylum policy in destination D_2 also increases the option value of residing in D_1, as destination D_2 still grants asylum to individuals who have previously been to destination D_1. As a consequence, the number of people deciding to leave transition country T will increase and this may increase the number of arrivals in destination D_1.

4 Identification and Calibration

4.1 Data Moments

Representative micro-data on Syrian refugee migration are still scarce. We thus identify the structural parameters of the model by calibration to the fraction of the Syrian population registered by the UNHCR in Iraq, Jordan, Lebanon and Turkey, the fraction that has applied for asylum in European Union countries, their acceptance rates, as well as the rate at which Syrian individuals not accepted for asylum leave. Our focus on international refugee migration implies that we abstract from internal displacement and subsume internally displaced persons within Syria under the fraction of the population that has not moved to either T, D_1 or D_2.

We use data from 2014, when refugee migration into Europe picked up, but before a number of countries introduced border controls to neighbouring EU member states.[12] We divide EU countries into two groups, based on their geographic location and the corresponding exposure to Syrian refugees passing through their territory. Figure 4 shows this categorization for the 30 European countries we consider.[13] D_1 includes Bulgaria, Croatia, Cyprus, Greece, Hungary, Italy, Malta, Romania and Slovenia while D_2 includes Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Latvia, Lituania, Luxembourg, The Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. Our results do not depend strongly on where exactly we draw the border between D_1 and D_2, and whether for instance Austria is included in one or the other group. Furthermore, because of the very low application numbers in many countries, their exclusion from the analysis or inclusion in the respectively other group does not alter our results. According to the UNHCR data, the new EU member states Czech Republic, Estonia, Latvia, Lithuania, Poland and Slovakia for instance, which we include in D_2, received a total of only 442 asylum appli-

[12]Besides the successive introduction of border controls and the construction of physical barriers in 2015, a number of major events affected Syrian refugee migration that are beyond the scope of our model. The most important ones are the food supply crisis in refugee camps in Jordan and the beginning of Russian military intervention in Syria, both of which contributed to the surge in refugee numbers arriving in Europe in 2015.

[13]We include Norway and Switzerland throughout in our analysis.

cations in 2015 (less than Luxembourg with 630). Their inclusion in either or none of the groups hence does not affect the moments targeted in the estimation and the parameter estimates obtained.

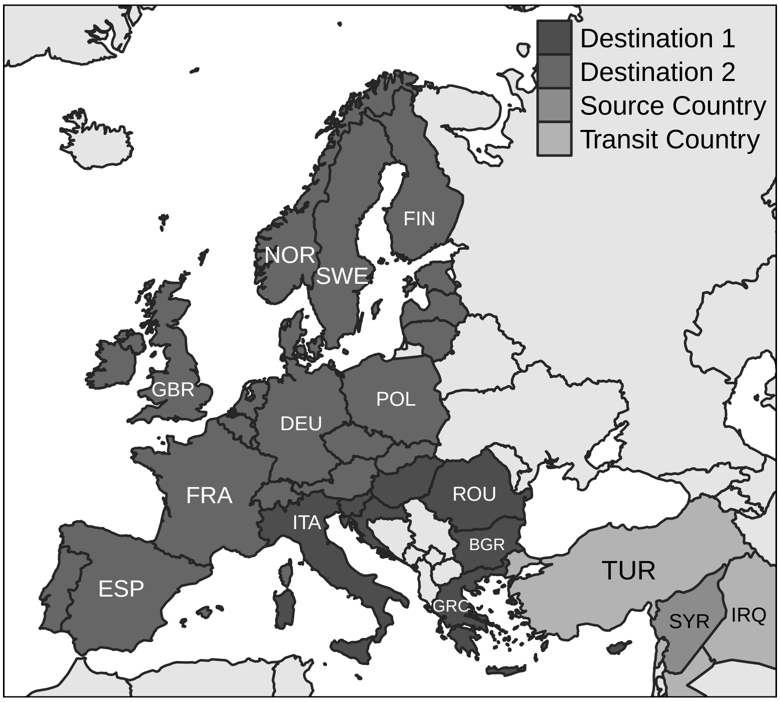

Figure 4: European destination countries: D_1 includes Bulgaria, Croatia, Cyprus, Greece, Hungary, Italy, Malta, Romania and Slovenia; D_2 includes Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Latvia, Lithuania, Luxembourg, The Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

By end of 2014, the UNHCR counted the number of Syrian refugees in the major neighbouring host countries Iraq, Jordan, Lebanon and Turkey at $N_T = 3,718,001$, while the number of Syrian asylum applications in the D_1 group of European countries between April 2011 and December 2014 stood at $N_{D_1} = 27,629$ and that in the D_2 countries at $N_{D_2} = 120,562$.[14] We use the ratio of these numbers to the Syrian population ($N_S = 21,070,917$)[15] before the outbreak of the Syrian civil war in 2011 to identify the

[14] http://data.unhcr.org/syrianrefugees/regional.php, accessed on 01.03.2016. Note that we observe asylum applications rather than the number of people passing through D_1. In the model, a direct move from T to D_2 is thus interpreted as passing through D_1 without registration as an asylum seeker. This was the case for the majority of refugees passing through South-Eastern Europe who then applied for asylum in a Northern European destination.

[15] http://data.worldbank.org/country/syrian-arab-republic, accessed 01.03.2016.

relative attractiveness of these destinations. To separately identify the flow utility from being in these locations as an accepted asylum seeker relative to a not accepted one we further use information from EuroStat[16] on the out-migration rate of Syrian individuals who have not been accepted. This rate is computed as the number of voluntary returns to third (i.e. non-EU) countries from D_1 and D_2 (1,920 and 475) in 2014 relative to the number of Syrian nationals ordered to leave the two groups of destinations (39,060 and 5,630) during the same period. Finally, the shares of pending and new applications by Syrians in D_1 and D_2 recorded by UNHCR that were accepted in 2014 are 44.4 and 49.0 percent respectively. Table 1 lists the data used in the estimation.

N_T/N_S	0.176
N_{D_1}/N_S	0.001
N_{D_2}/N_S	0.006
$P[return \mid l = D_1, r = n]$	0.049
$P[return \mid l = D_2, r = n]$	0.084
p_1	0.444
p_2	0.490

Table 1: Data used for calibration. Sources: Refugee numbers and recognition rates are from UNHCR; the Syrian population in 2011 from the World Bank; voluntary returns by applicants not accepted for asylum are from EuroStata; see text for details.

4.2 Identification

Besides the policy parameter p_d, an important determinant of an individual's location choice are the unobserved payoffs received. Our aim is to calibrate the vector of these structural parameters $\tilde{\theta} = (v_T, v_{D_1,n}, v_{D_1,a}, v_{D_2,n}, v_{D_2,a}, \rho_1, \rho_2)$ to gain insights into the effects of policy choices on refugee flows.[17] We do so according to the following procedure: Since refugees are assumed to take recognition rates as given, the inner part of the model that describes the choices of refugees can be calibrated conditional on (p_1, p_2). In a second step, we use the observation made in Section 3.2 that each country achieves the optimal number of refugees in any interior equilibrium of the game among destinations. Thus, we can set the optimal shares of the Syrian population of each destination, ρ_1 and ρ_2,

[16] http://ec.europa.eu/eurostat/data/database, accessed 01.03.2016.

[17] Note that a normalization requires us to set to v_S to zero. The data we have available also do not allow identification of the discount factor, and so we set $\beta = 0.95$. Based on World Bank information, life expectancy is fixed at $\tau = 75$.

equal to the predicted shares obtained from the calibrated model given the utility flows previously obtained.[18] (Note that only an interior equilibrium can fit the data well as the observed annual acceptance rates are 0.444 and 0.490.)

The structural parameters we calibrate jointly in the first step are therefore summarised by the vector $\theta = (v_T, v_{D_1,n}, v_{D_1,a}, v_{D_2,n}, v_{D_2,a})$. We use the model to simulate a population of 1 million Syrian-born individuals who after the outbreak of the civil war may move to T and possibly further on to D_1 and D_2.[19] As Figure 5 illustrates, the number of refugees from Syria prior to 2011 was negligible compared to the current numbers.[20] We thus trust that our data on Syrian refugees in the various locations indeed refer to Syrians who were displaced due to the conflict since 2011. Depending on their age, however, the outbreak of the war in 2011 hit individuals at different stages of their life. To account for this, we draw the simulated population from the empirical age distribution of the 2011 Syrian population[21] and consider stocks and flows in different locations four years later, corresponding to 2014, the year we observe the aggregate numbers targeted.

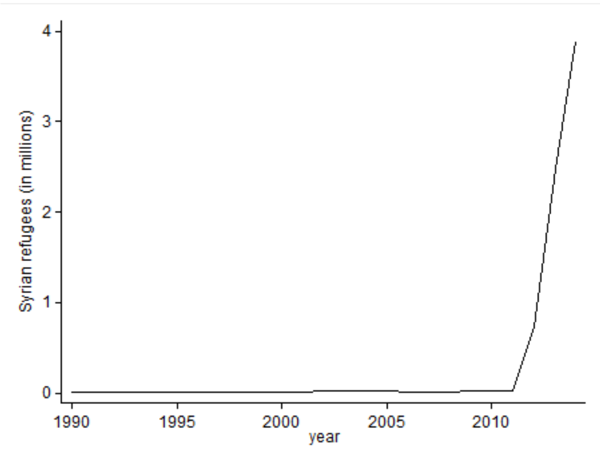

Figure 5: Syrian refugees since 1980. Source: UNHCR Population Statistics Reference Database.

To solve the refugee's location choice problem we find optimal decision functions by backward induction and then simulate refugee flows and stocks across destinations. This enables us to construct counterparts to the moments listed in Table 1 for the simulated population, and search for the value of parameter vector θ that minimises the (weighted

[18]A calibration of the optimal shares of Syrians residing in each destination to match observed recognition rates is also possible, but would similarly yield optimal shares equal to the predicted shares.

[19]Because for the years we consider some choice probabilities are small (such as the probability of applying for asylum in D_1), the calibration requires a large number of simulations.

[20]http://popstats.unhcr.org, accessed 01.03.2016.

[21]http://data.worldbank.org/country/syrian-arab-republic, accessed 01.03.2016.

squared) distance between these simulated moments and their empirical counterparts. Accordingly, the objective function we minimize is given by

$$crit = (\mathbf{m_d} - \mathbf{m_s}(\theta))'\mathbf{W}(\mathbf{m_d} - \mathbf{m_s}(\theta)),$$

where $\mathbf{m_d}$ and $\mathbf{m_s}$ are vectors $(N_T/N_S, N_{D_1}/N_S, N_{D_2}/N_S, P[return|l = D_1, r = n],$ $P[return|l = D_2, r = n])'$ of the targeted empirical and simulated moments, respectively. Note that these are not sample but population moments. In the absence of standard errors for these moments, a convenient choice for the weighting matrix $\mathbf{W}$ is a diagonal matrix with the inverse targeted empirical values $\mathbf{m_d}$ on the diagonal. The criterion thus measures the squared deviation between empirical and simulated moments in percentage terms (relative to the empirical magnitude of each element of $\mathbf{m_d}$). Identification of the model parameters through our set of moments requires that gradient vectors for all parameters are linearly independent. To formally show that this is the case, we compute the eigenvalues of $\frac{\partial \mathbf{m_s}'}{\partial \theta}$. We obtain as many different non-zero eigenvalues as there are parameters, so that our set of moments point identifies the structural parameters under the model (see Appendix B for details).

5 Results

Panel (a) of Table 2 lists the resulting utility flows. Panel (b) further shows that the model closely replicates the five targeted data moments. Identification requires that the location and scale of utility flows be normalized. We do this by setting $v_S = 0$ and normalizing the variance of transitory shocks ϵ to one. The calibrated values for v_T, $v_{D_1,n}$, $v_{D_1,a}$, $v_{D_2,n}$ and $v_{D_2,a}$ thus denote utility flows relative to the payoff from being in S. In the absence of shocks ϵ prior to the outbreak of the Syrian conflict in 2011, the model predicts no out-migration, in line with the very low numbers actually observed. Starting in 2011, an individual may leave S if he or she is hit by a large shock despite the lower utility flow in T and the very low payoff as a not-yet-accepted asylum seeker in D_1 and D_2.

We use the calibrated model to examine the effects of a change in the acceptance rate of asylum applications. While very few requests for asylum by Syrians are actually rejected (see Figure 1), a policy margin that countries of asylum can exploit to attract more or less asylum requests and that is well-measured is the speed with which applications are processed. Our model thus focuses on annual recognition rates, which are a direct determinant of these durations.

(a) Calibrated Parameter	Value
utility gain in T, $(v_T - v_S)$	-4.740
utility gain in D_1 when not accepted, $(v_{D_1,n} - v_S)$	-11.577
utility gain in D_1 when accepted, $(v_{D_1,a} - v_S)$	0.504
utility gain in D_2 when not accepted, $(v_{D_2,n} - v_S)$	-10.940
utility gain in D_2 when accepted, $(v_{D_2,a} - v_S)$	0.575

(b) Targeted Value	Data	Model
arrivals in T/N_S	0.176	0.151
arrivals in D_1/N_S	0.001	0.001
arrivals in D_2/N_S	0.006	0.006
$P[return \mid l = D_1, r = n]$	0.049	0.053
$P[return \mid l = D_2, r = n]$	0.084	0.071

Table 2: Calibrated values and model fit. v_S is normalized to 0, so that estimates of utility flows in other states are relative to that in S.

5.1 Equilibrium and Best Response Functions

If several potential destination countries cannot agree on common asylum recognition and allocation policies, spillovers from a unilateral change in one country's recognition rate may trigger an adjustment in another destination's policies. Several mechanisms are at work: If a rise in one destination's recognition rate attracts many refugees to Europe who end up applying for asylum in another destination, the latter may lower its acceptance rate in response. If, on the other hand, a higher recognition rate primarily diverts refugee flows towards the destination in which the probability of being accepted—and thus the expected life time value—has increased, the now relatively less attractive destination may see room for accepting a larger fraction of the asylum applications it receives. Which of these two effects dominates will determine whether best response functions are upward or downward sloping, and thus whether recognition rates in this game between destinations are strategic complements or substitutes.

To examine the strategic role of asylum policies, we simulate refugee migration patterns for a grid of both destinations' recognition rates and evaluate the resulting payoff to the destinations as given in equation 2. Figure 6 shows heat-maps of these payoffs as a function of the two destinations' policies, with darker areas indicating higher payoffs, and the respectively other destination's recognition rate on the the horizontal axis. A destination's best response function then is the recognition rate which, for any level of the respectively other destination's policy, yields the highest payoff.[22]

The figure reveals several interesting observations: First, over a wide range of their

[22]We simulate refugee numbers for 100 policy combinations and use a two dimensional cubic spline interpolation to obtain continuous patterns.

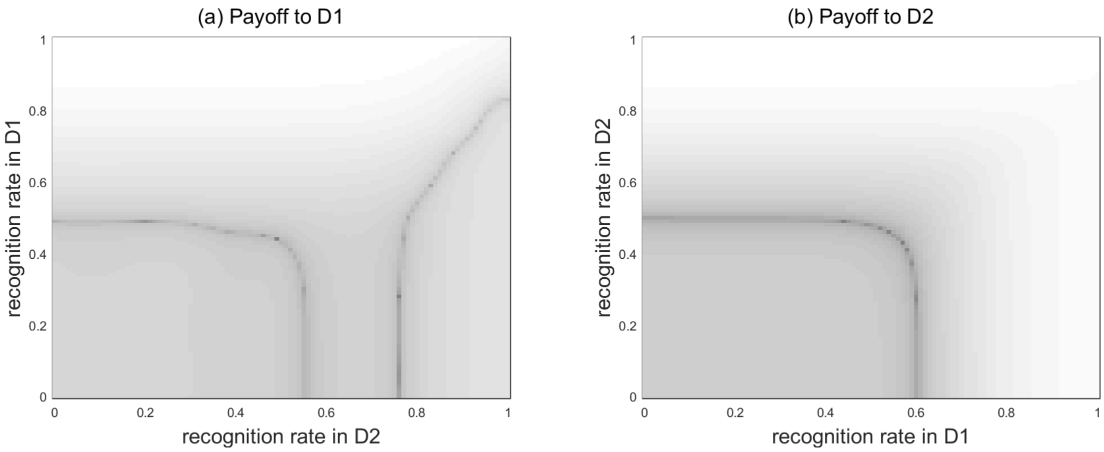

Figure 6: Heat-maps of estimations' payoffs as a function of the own and other destination's policy

domain best responses are decreasing functions of the respectively other destination's policy, though with strongly varying elasticities. Second, at low levels of p_1 (p_2) the best response by destination D_2 (D_1) is fairly unresponsive, but becomes more elastic for recognition rates p_1 (p_2) of around 40-60 percent. In this range, recognition rates hence are strategic substitutes. Third, destination D_1's best response actually is non-monotonic. While it is downward sloping or flat for levels of p_2 up to 78 percent, it is an increasing function when recognition rates are high in D_2. The reason is that at low levels of p_2 an increase draws more refugees to Europe and the resulting increase in applications in destination D_1 dominates the diversion of refugees from D_1 to D_2. The higher utility refugees derive from being accepted in D_2 implies that at very high levels of p_2, few refugees apply for asylum in D_1, and asylum policies there ultimately become more generous. It is important to stress that none of this is imposed by our assumptions. Under different parameter values, recognition rates at the equilibrium can become strategic complements. Thus, even though we use a fully specified structural model, we do not impose any shape restrictions on the two destinations' best response functions.

To examine effects at the equilibrium, we plot the reaction functions for destinations D_1 and D_2 together in Figure 7, showing the entire policy space in the left graph and zooming in on the equilibrium in the right. The light solid line $R_1(p_2)$ is D_1's optimal acceptance rate (on the horizontal axis) given the policy of D_2 (on the vertical). Similarly, the dark dashed line $R_2(p_1)$ depicts D_2's best responses to D_2's acceptance rates. The two curves intersect at the game's Nash equilibrium. The negative slopes around the equilibrium suggest that acceptance rates are strategic substitutes in our setting, though more so from destination D_1's perspective. Part of this asymmetry derives from the asymmetric enforcement of the Dublin agreement: For a refugee in location T, a higher acceptance rate in D_2 raises the expected value of being there. However, since refugees can transit through D_1 and still be accepted for asylum in D_2 even after having claimed asylum in the former, the expected value of moving to D_1 rises as well. This attracts refugees to D_1, some of whom will move on, while others may be accepted for asylum and stay. Thus, there are two competing effects on the number of refugees applying for asylum in D_1, a diversion and an attraction effect. Around the equilibrium, our calibrated model suggests that the latter effect dominates. To counteract this rise in arrivals beyond D_1's desired level, recognitions are strongly reduced if D_2 raises its acceptance rate beyond 45 percent.

As refugees who have been to destination D_2 cannot be accepted for asylum in D_1, the attraction effect described in the previous paragraph does not apply to D_2 after changes in the acceptance rate of D_1. Nevertheless, destination D_2's best response function is slightly downward sloping around the equilibrium. The reason is that realizations of shocks ε vary over time and that if D_1 raises its recognition rate, some refugees who moved to T (which is a precondition for getting to either D_1 or D_2) may in the end apply for asylum in D_2 rather than as initially planned in D_1. This latter externality applies to both destinations, but is much weaker than the asymmetric one described earlier. Taken together, the reaction function for D_2 is less elastic, and a strong response only occurs if D_1 sets a recognition rate higher than 50 percent.

In Section 5.3 below we assume that both destinations enforce the Dublin agreement to the same extent, so that a symmetric model results. With this modification, European destinations only differ in their preference for asylum seekers and in the payoffs refugees enjoy, which via the calibration are determined by data. Under both models, the value of being in destination D_2 is estimated to be higher, to match the higher number of asylum applications. Similarly, in line with the higher recognition rate in D_2, the ideal number of refugees for D_2, ρ_2, is predicted to be higher than that in D_1. These differences also affect the asymmetry in the reaction functions.

Figure 7 also shows the extent to which countries can mitigate the externality they face. Both destination are able to offset any reduction in the other destination's recognition rate through a more generous policy of their own. Small increases in the other destination's recognition rate can be mitigated as well, but eventually induce a reduction of the own acceptance rate to zero. Beyond this point the number of refugees arriving increases. As explained though, the change in refugee arrivals to destination D_1 reverses for high recognition rates in D_2, as does the policy response, once D_2 chooses an annual acceptance rate of more than 78 percent.

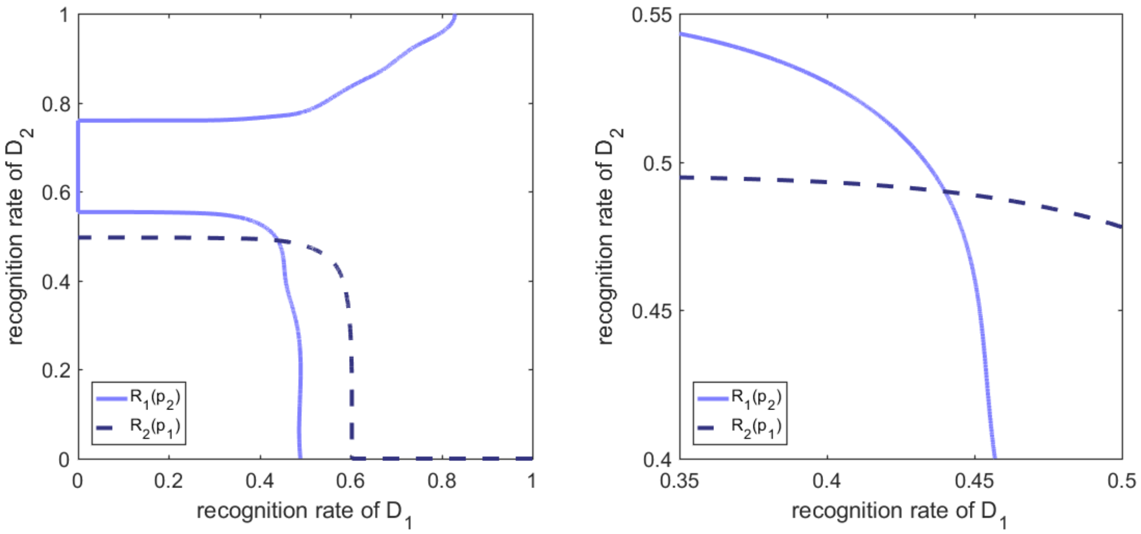

Figure 7: Mutually best responses in the game between destinations. The left graph shows the best response functions over the entire policy space; the right graph zooms in on the equilibrium.

5.2 Effects of Asylum Policies

To evaluate the effect of a destination's recognition rate on the number of asylum applications, we use the model to predict changes in refugees' location choices. Starting from the prevailing equilibrium, an increase in either destination's recognition rate may either raise or reduce the number of refugees arriving in the other destination, depending on whether the diversion or the attraction effect dominates. The downward sloping best response functions in Figure 7, however, suggest that the attraction effect dominates, making recognition rates strategic substitutes. For concreteness, consider a rise in the probablity of being accepted for asylum in Northern Europe. This attracts additional refugees into South and South-Eastern Europe beyond the level governments there deem desirable, inducing them to adopt more restrictive asylum policies. Such a reduction in acceptance rates may in turn have a feedback effect that lowers the number of asylum seekers arriving in Europe as a whole, including in the North. If both spillover and feedback effects are present, this reduces the overall effect of a change in asylum policies in Northern Europe compared to the effect predicted by a pure partial equilibrium model. If, on the other hand, one of the two effects is close to zero, effects predicted by a partial equilibrium model will be close to those predicted by a model that accounts for endogenous policy choices.

We summarize these in Table 3. In the absence of any policy response by D_2, an increase in destination D_1's recognition rate by 1 percent raises the number of refugees arriving there by 0.31 percent, as can be seen in column (1). In fact, the spillover to destination D_2 of 0.05 percent is small, only inducing a mild policy response there (columns (2) and (3)). Hence, the partial equilibrium effect, which ignores the spillover, is in fact similar to the full elasticity shown in the last column.

The effect of a change in destination D_2's recognition rate is quite different. In particular, the spillover effect to D_1 is much stronger, raising the number of refugees arriving there by over 0.18 percent. This triggers a strong policy response in D_1, where the recognition rate is lowered by 0.29 percent. Nevertheless, since refugee numbers in D_2 are much less responsive to policy changes in D_1, the feedback effect is small, as is the difference between partial and general equilibrium effects. The overall elasticity for D_2 is 0.42.

	(1)	(2)	(3)	(4)
	Δ arrivals in $D_1 \mid p_2$	Δ arrivals in D_2	Δ p_2	Δ arrivals in D_1
1% change in p_1	0.309%	0.050%	-0.060%	0.288%
	Δ arrivals in $D_2 \mid p_1$	Δ arrivals in D_1	Δ p_1	Δ arrivals in D_2
1% change in p_2	0.452%	0.184%	-0.290%	0.424%

Table 3: Effects of a change in each destination's recognition rate.

These predictions are higher than the regression coefficients obtained from cross-country variation in Section 2. We attribute this to two factors: First, as suggested by the comparison across a number of major origin countries in Figure 3, the association between recognition rates and numbers of applications is particularly high for Syrian refugees. To the extent that these correlations reflect differences in the structural relation between recognition rates and application numbers across refugee populations, the causal effect for many other origin countries would likely be lower. Second, at least for some destinations, there are positive spillovers on applications in other locations, which in turn induce a negative policy response there. This suggests that recognition rates are strategic substitutes at the equilibrium. Both of these factors cause a downward bias when the effect is estimated by comparing policies and application numbers across destinations, as is done in a regression framework.[23] Hence, understanding the direction and magnitude of policy responses is crucial, since the bias in reduced form estimates cannot be signed without knowing the strategic role of asylum policies.

It is important to note that the underestimation of the effect in a regression framework

[23]To illustrate, consider a simple linear model $s_i = \alpha + \delta p_i + u_i$, where s_i, p_i and u_i denote application numbers, asylum policies and unobserved factors determining applications in country $i = 1, 2$. If p_1 and p_2 are strategic substitutes, then regression estimates $\hat{\delta} = \delta + (u_2 - u_1)/(p_2 - p_1)$ underestimate the true effect of p on s, even if p_i and u_i are uncorrelated (see Appendix C for further details).

is distinct from the overestimation by a structural model that abstracts from equilibrium effects. The former arises from spillovers, which invalidate cross-country comparisons. The latter, in contrast, involves no comparison across destinations, as a behavioural model is used to predict the effect from a counterfactual simulation directly. The difference between partial and general equilibrium effect here arises solely if there is a feedback effect via the other destination's strategic policy response.

Another result that is masked in a linear regression framework is that policy changes have a highly non-linear effect. Figure 8 plots the percentage change in the number of arrivals against changes a destination's own annual recognition rate. For instance, the left graph shows that while an increase in the annual recognition rate by 10 percentage points is predicted to raise the number of asylum seekers by about 18 percent, an equally sized reduction in recognition rates has a much lower effect (in absolute terms) and reduces the number of arriving refugees by about 3 percent for D_1 and less than 6 percent for D_2.

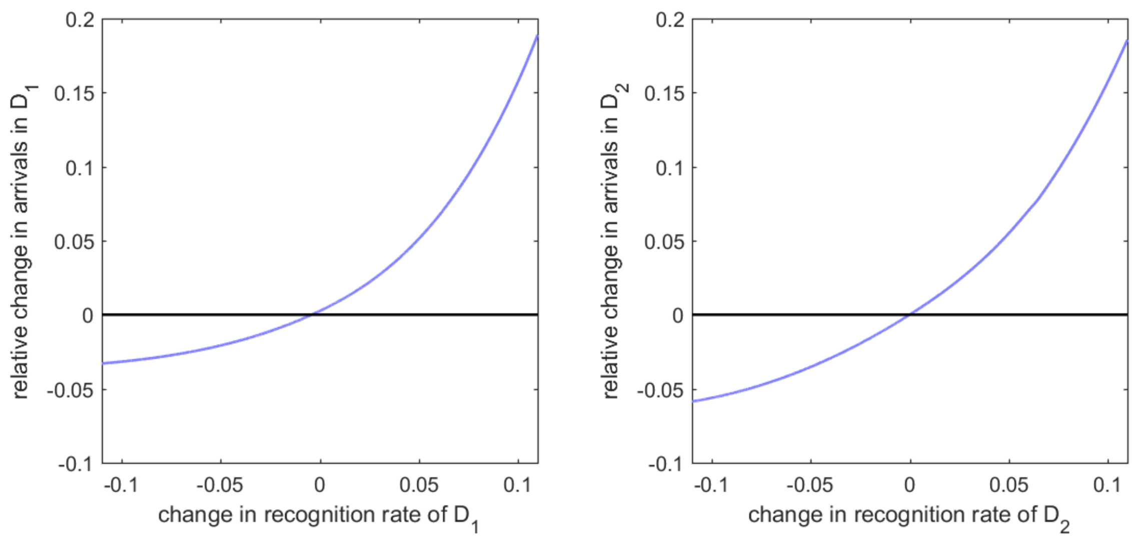

Figure 8: Non-linearity of the effect of a change in recognition rates on the arrivals of refugees.

Although our focus in this paper is on the effects of recognition rates, governments have other policy parameters available to potentially influence the number of asylum applications. The most obvious one are the benefits received by asylum seekers. We argue above that many, partly unobserved, factors determine individual preferences toward a given location, and that a narrowing down of the utility flow to monetary values remains necessarily incomplete. Nevertheless, the calibrated model can be used to evaluate the effect of changes in flow utilities. Such changes cannot easily be quantified, and we express them in terms of the difference between the flow utility received as refugee accepted for asylum in Northern Europe, $v_{D_2,a}$, and the one a non-displaced individual in Syria would enjoy, v_S. At constant recognition rates, an increase by 10 percent of that difference[24] results in a 3.65 percent increase in refugees arriving in D_2. The corresponding change for destination D_1 resulting from an equally sized rise in payoff $v_{D_1,n}$ is 3.01 percent.

5.3 Comparison to a Symmetric Model

Part of the asymmetric spillovers and policy responses across destinations is due to our assumption that refugees, after having passed through South-Eastern Europe, can still apply for asylum further North, while the opposite is ruled out. This assumption was driven by the observed asymmetric enforcement of the Dublin agreement vis-à-vis Syrian refugees and makes the model more applicable to the context we consider. Nevertheless, we also calibrate a symmetric model, where refugees also can apply for asylum in D_1 after having been in D_2, keeping all other assumptions unchanged. That is, as before, if an individual arrives at a destination after previously having left it, he or she will not be accepted for asylum. Similarly, once accepted for asylum in one destination, no application can be filed elsewhere.

The maximised continuation values of equation (1) then become

$$\begin{aligned}
\widetilde{V}_{D_1,n_{(1,1)}} &= \max\{V_{T,n_{(0,0)}}, p_1 V_{D_1,a} + (1-p_1)V_{D_1,n_{(1,1)}}, V_{D_2,n_{(0,1)}}\} \\
\widetilde{V}_{D_2,n_{(1,1)}} &= \max\{V_{T,n_{(0,0)}}, V_{D_1,n_{(1,0)}}, p_2 V_{D_2,a} + (1-p_2)V_{D_2,n_{(1,1)}}\} \\
\widetilde{V}_{D_1,n_{(1,0)}} &= \max\{V_{T,n_{(0,0)}}, p_1 V_{D_1,a} + (1-p_1)V_{D_1,n_{(1,0)}}, V_{D_2,n_{(0,0)}}\} \\
\widetilde{V}_{D_2,n_{(0,1)}} &= \max\{V_{T,n_{(0,0)}}, V_{D_1,n_{(0,0)}}, p_2 V_{D_2,a} + (1-p_2)V_{D_2,n_{(0,1)}}\} \\
\widetilde{V}_{D_d,n_{(0,0)}} &= \max\{V_{T,n_{(0,0)}}, V_{D_d,n_{(0,0)}}, V_{D_{d^-},n_{(0,0)}}\} \\
\widetilde{V}_{D_d,a} &= \max\{V_{T,n_{(0,0)}}, V_{D_d,a}, V_{D_{d^-},n_{(0,0)}}\}.
\end{aligned}$$

Calibration of this symmetric model yields parameter values $(v_T, v_{D_1,n}, v_{D_1,a}, v_{D_2,n}, v_{D_2,a}, \rho_1, \rho_2) = (-5.473, -11.358, 0.532, -10.075, 0.537)$. Although these values are similar to our initial model, the symmetric model yields approximately the same flow utilities for accepted refugees in the D_1 and D_2.[25] As a consequence, even at high recognition rates in D_2 the diversion effect from D_1 to D_2 is not strong enough to trigger an increase in D_1's recognition rate p_1 in response to a further rise in p_2. In this model, recognition rates are thus strategic substitutes (or independent) everywhere. Figure 9 shows the best responses for the symmetric model. It also reveals that much of the asymmetry at the

[24] If $v_{D_2,a} - v_S$ was taken to be the difference in GDP per capita between Northern Europe and Syria, then this 10 percent change would amount to approximately USD 3,500 per year.

[25] In our preferred model, the option of being accepted for asylum in D_2 after having been to D_1 raises the relative value of the latter. To match the lower observed application numbers in D_1, the calibration yields a lower flow utility v_{1a}, also in line with worse economic prospects in Southern Europe.

equilibrium remains and is not only driven by the way we capture enforcement of the Dublin agreement in our preferred model. Rather, the asymmetry in best responses results from asymmetric preferences towards refugees and the remaining differences in the payoffs to individuals across destinations, which in turn derive from the actually observed acceptance rates and the refugee numbers to which we calibrate the model.

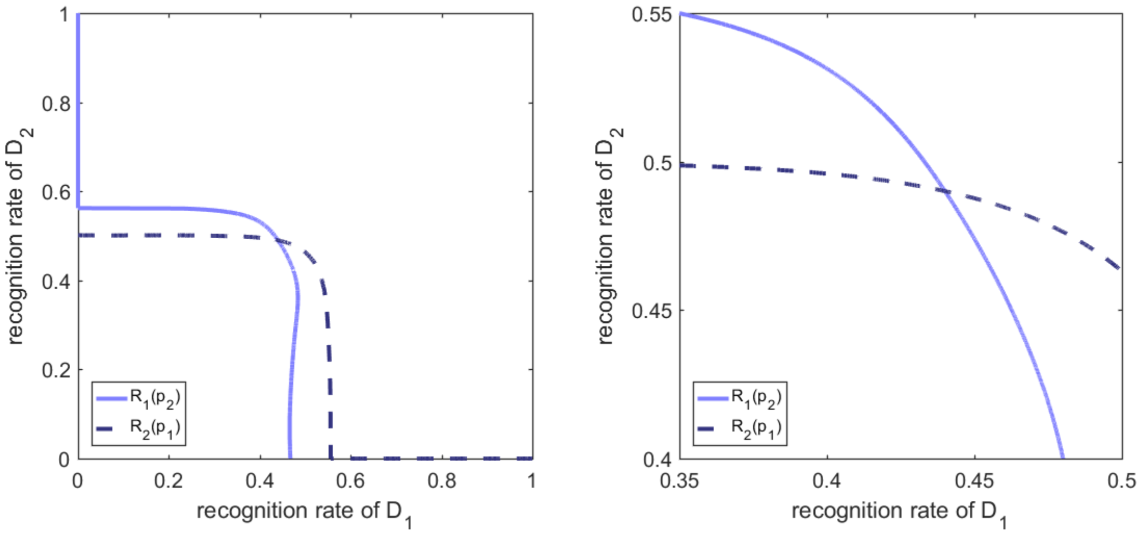

Figure 9: Mutually best responses in the game between destinations in a symmetric model. The left graph shows the best response functions over the entire policy space; the right graph zooms in on the equilibrium.

Thus, spillover effects from destination D_1 to D_2 are still smaller than the spillover from D_2 to D_1, as in our preferred model that accounts for the asymmetric enforcement of the Dublin agreement. Table 4 lists the effects of changes in a destination's recognition rate on the number of arriving refugees, as well as on the policy response by the respectively other destination in a symmetric model, analogous to those reported in Table 3. The estimated overall elasticities of refugee numbers with respect to recognition rates are within the range of those obtained from our preferred specification.

6 Conclusion

The importance of asylum policies as a pull factor for refugees is fiercely debated in the context of the recent refugee crisis and the large numbers of asylum seekers who have arrived in Europe during the last few years. In this paper, we attempt to quantify the effect of asylum recognition rates on application numbers. Based on descriptive evidence on the joint distribution of recognition rates and applications, we highlight two factors that raise questions about the use of a regression framework in this context: First, we

	(1)	(2)	(3)	(4)
	Δ arrivals in $D_1 \vert p_2$	Δ arrivals in D_2	Δ p_2	Δ arrivals in D_1
1% change in p_1	0.313%	0.085%	-0.100%	0.269%
	Δ arrivals in $D_2 \vert p_1$	Δ arrivals in D_1	Δ p_1	Δ arrivals in D_2
1% change in p_2	0.406%	0.217%	-0.330%	0.352%

Table 4: Effects of a change in each destination's recognition rate as predicted by the symmetric model.

find heterogeneity across different origins in the correlation between the two variables. Given the specificity of the various contexts in which forced migration occurs, learning about a particular case from variation across very different origins appears questionable. Second, especially when considering migrations to a close set of destinations, spillover effects imply that observations in cross-country datasets are not actually independent, violating a core condition for the consistency of regression estimates. Neither of these concerns can be mitigated by the availability of instrumental variables.

We thus formulate and calibrate a dynamic behavioural model, which allows us to focus more directly on the important case of Syrian refugee migration to Europe, and at the same time accounts for a potential strategic interaction between different destinations. This approach is new to the literature on refugee migration, and we relate its predictions to the bias arising in a regression framework. Our framework does not impose the strategic role of asylum policies. However, based on the calibrated model, we find that recognition rates are strategic substitutes at the equilibrium. We obtain an elasticity of refugee arrivals with respect to annual recognition rates of 0.29-0.42. While calibration of the model to data on Syrian refugees makes it more credible for this particular context, it also implies that the elasticities we estimate apply to this specific refugee population. The lower correlations between recognition rates and asylum applications for a number of other major sending countries suggests that the responsiveness of arrivals to asylum policies may be lower in other contexts.

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Appendix (for online publication)

A Data Appendix for the Descriptive Analysis of Section 2

This appendix lists summary statistics for the UNHCR data used for the descriptive analysis in Section 2 in more detail. Table 5 shows the means and standard deviations of the main variables provided in the Statistical Yearbook 2014 that we use.

Variable	**All Origins**	
	Mean	Std. Dev.
Pending applications at beginning of year	1,142.2	3,528.1
New applications	1,786.3	10,190.8
Applications processed	1,490.7	9,875.9
Recognition rate	15.6%	0.193
Recognition rate | decision made	33.0%	0.318
Applications/million of origin population	105.2	390.5
Observation points	796	

Table 5: Asylum applications and recognition rates. Source: UNHCR Statistical Yearbook 2014.

Applications from a total over one hundred origin and destination countries are recorded in 2014, with positive application numbers for about 800 country pairs. Conditional on there being any applications, each destination received an average of 1,786 new applications from each origin, while 1,142 pending applications were carried over from the previous year. The recognition rate, that is the fraction of pending and new applications that is accepted during a given year, is 16 percent on average, conditional on a decision being made it is 33 percent. It is important to note that these bilateral data only include refugees who formally apply for asylum under the Geneva Convention. This is not the case for the vast majority of Syrian refugees, for instance, who enjoy group protection in the main receiving neighbouring countries, but are not granted asylum under the Geneva Convention. When we focus on Syrians in the main part of this paper, however, we do consider all Syrian refugees in neighbouring countries.[26] To compute the number of asylum seekers relative to the size of the origin population, we augment our dataset with population sizes provided by the World Bank (2016). The mean number of applications from a given origin in 2014 was 361 out of every million individuals, conditional on there being any. This breaks down to an average of 105 out of a million per origin-destination observation.

[26]Data for this are taken from http://data.unhcr.org/syrianrefugees/regional.php.

B Local Identification

In this appendix, we show local identification of the model parameters through our set of moments. Figure 10, which plots the (log) criterion against different values of the structural parameters, shows that the criterion obtains a clear local minimum at the given parameter values. In order to show identification more formally, Table 6 lists the gradient matrix $\frac{\partial \mathbf{m_s}'}{\partial \theta}$. Identification requires that gradient vectors for all parameters are linearly independent. To ensure that this is the case, we compute the eigenvalues of $\frac{\partial \mathbf{m_s}'}{\partial \theta}$. These are 18.3, -8.6, 0.9, 0.2 and 0.4. Since we obtain as many different non-zero eigenvalues as there are parameters, our set of moments point identifies the structural parameters under the model.

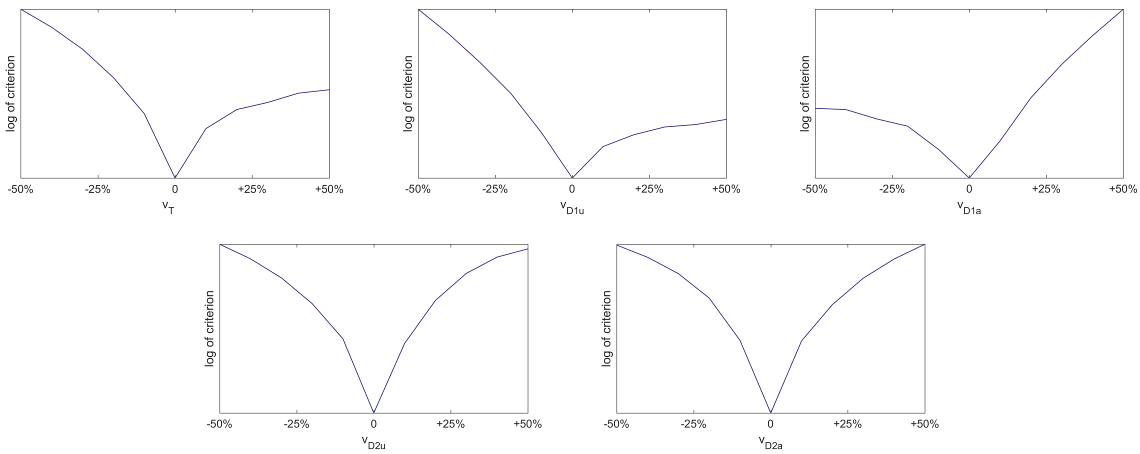

Figure 10: Local minima of the criterion function with respect to values of the structural parameters.

Parameters	arr T	arr D_1	ret D_1	arr D_2	ret D_2
	Moments				
v_T	0.531	0.015	0.106	0.199	1.985
v_{D1u}	0.366	0.428	0.235	7.475	5.336
v_{D1a}	0.453	0.018	0.606	0.288	11.581
v_{D2u}	-1.426	-0.129	-1.199	18.305	-4.429
v_{D2a}	0.568	-0.016	-0.264	-0.339	-8.769

Table 6: Gradient matrix $\frac{\partial \mathbf{m_s}'}{\partial \theta}$

C Relation to Non-equilibrium Frameworks

In this appendix, we relate our findings and the model used more explicitly to linear estimators and non-equilibrium frameworks. The descriptive evidence in Section 2 points—besides considerable heterogeneity across refugee populations—toward an on average positive correlation between asylum recognition rates and application numbers.

Our main concern was that spillovers and strategic responses may invalidate estimations which rely on cross-country variation. To see this, consider the following simple setup, where s_i and p_i denote application numbers and asylum policies, and where u_i are unobserved factors determining asylum applications in country D_i, where $i = 1, 2$:

$$s_1 = \alpha + \delta p_1 + u_1$$
$$s_2 = \alpha + \delta p_2 + u_2.$$

Consider first a case in which policies p_1 and p_2 are strategic substitutes. If destination D_2's acceptance probability p_2 positively affects u_1 and thus the number of refugees in destination D_1 conditional on p_1, then the regression estimate

$$\hat{\delta} = \delta + (u_2 - u_1)/(p_2 - p_1) \tag{3}$$

will underestimate the true effect of a country's asylum policy p_2 on applications in destination D_2. A decrease in destination D_1's acceptance probability p_1 in response to this reinforces the bias, and more so if the lower p_1 has a negative feedback effect on u_2. This bias also arises if p_2 and u_2 are uncorrelated.

In contrast, if asylum policies p_1 and p_2 are strategic complements, an increase in destination D_2's acceptance probability p_2 induces a rise in p_1. This is the case if the diversion of refugee flows away from destination D_1 dominates the number of additional asylum applications in D_1. The rise in p_2 then lowers u_1 and raises p_1, potentially mitigating part of the direct effect of p_2. As can be seen from equation 3, however, the overall bias direction for $\hat{\delta}$ is ambiguous in this case.

It is important to note that the issue here is a dependency across observations rather than a direct endogeneity of a country's policy with respect to the asylum applications it receives. In other words, this source of bias still exists if $\text{cov}(p_i, u_i) = 0$ or if an instrument for p_i was available.

Our approach circumvents spillover bias by putting more structure on the problem and by formulating a behavioural model that can be used to evaluate the effect of asylum policies on individual location choices. If in response to the spillover the policy of the respectively other destination adjusts so that there is a strategic element to the prob-

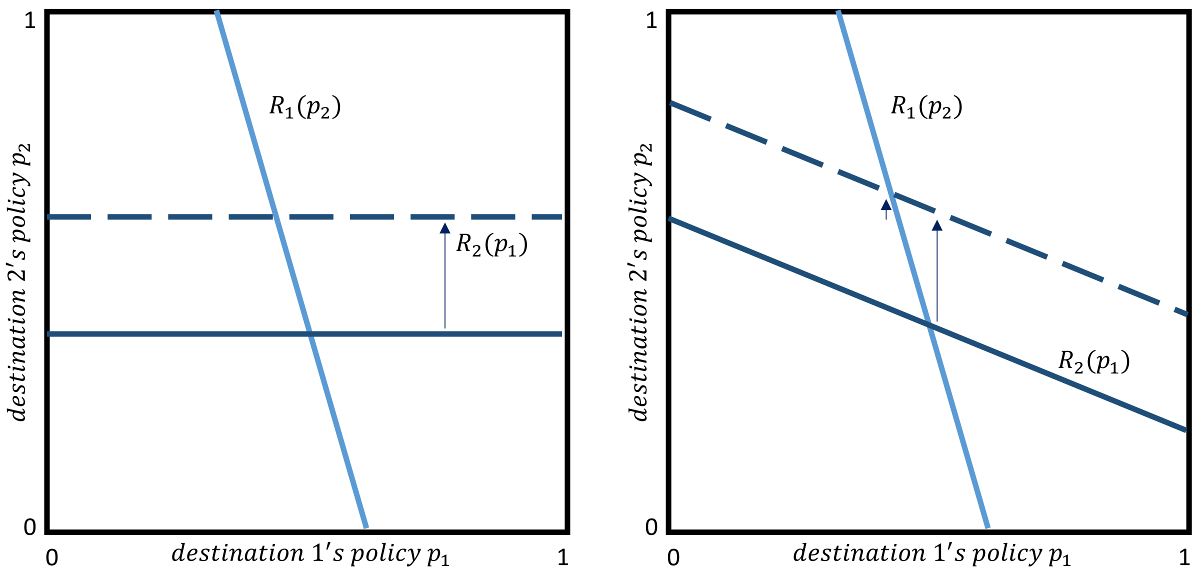

Figure 11: Patterns of mutually best responses.

lem, such a model further has to cover equilibrium effects. Figure 11 illustrates under what conditions the equilibrium has to be modeled. In the graphs, $R_1(p_2)$ and $R_2(p_1)$ denote the best response functions by destinations D_1 and D_2 to the policy set by the respectively other destination. The left panel depicts a scenario in which one destination has an inelastic reaction function: destination D_2's best response $R_2(p_1)$ does not depend on destination D_1's policy p_1. In this case, the spillover is one-sided. A change in destination D_2's policy p_2 creates a spillover effect on asylum applications in D_1 and triggers a response in p_1. While this is sufficient to bias estimates that are based on cross-country variation, there is no feedback effect on outcomes in destination D_2, and an equilibrium model does not predict a different effect on applications in destination D_2 than a structural partial equilibrium model would.

In contrast, the right panel of Figure 11 shows a scenario where both reaction functions are elastic with respect to the other destination's policy. As before, a change in p_2 triggers an adjustment in p_1. This response, however, now feeds back to application numbers in destination D_2, and the two destinations both adjust their policies until a new equilibrium is reached. In this case, the equilibrium effect needs to be accounted for. In our preferred model with an asymmetric enforcement of the Dublin agreement, the reaction function of one destination (D_2) turned out to be relatively inelastic, more similar to the first case. Slopes and shapes of the reaction functions, however, are unknown a priori. Sections 3-5 thus provides an equilibrium framework that lets—via the calibration—data determine whether asylum policies are strategic complements, substitutes or independent.