ECONOMICS

Macroeconomic evidence suggests that asylum seekers are not a "burden" for Western European countries

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This paper aims to evaluate the economic and fiscal effects of inflows of asylum seekers into Western Europe from 1985 to 2015. It relies on an empirical methodology that is widely used to estimate the macroeconomic effects of structural shocks and policies. It shows that inflows of asylum seekers do not deteriorate host countries' economic performance or fiscal balance because the increase in public spending induced by asylum seekers is more than compensated for by an increase in tax revenues net of transfers. As asylum seekers become permanent residents, their macroeconomic impacts become positive.

INTRODUCTION

Wars in Syria and in the Middle East in general have caused a major humanitarian crisis. The United Nations High Commissioner for Refugees reported that there were more displaced persons in 2015 than in any year since the Second World War. Europe alone received more than 1 million asylum applications, a situation widely described as a "migrant crisis." This article attempts to quantify the effects of inflows of asylum seekers on the economies of Western Europe. We examine effects on host countries' economic performance, as measured using gross domestic product (GDP) per capita, unemployment rate, and public finances. Relevant economic studies have mainly focused on the effects of permanent immigration and have reported divergent findings; in particular, certain studies have stressed the fiscal costs of particular categories of immigrants (1, 2) and the adverse effects of immigrants on natives' employment prospects (3), whereas others studies have highlighted the beneficial impacts of immigrants on host countries' economic performance (4–6). We aim to present a statistical analysis that includes all of the aforementioned variables and their possible interdependencies using a methodology that is typically used to assess the macroeconomic effects of fiscal and monetary policies. To provide a better understanding of the examined effects, our analysis distinguishes between flows of permanent migrants, as defined using international classifications (7), and flows of asylum seekers.

The present study uses annual statistical data from 15 Western European countries from 1985 to 2015. The selected countries are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Iceland, Italy, the Netherlands, Norway, Spain, Sweden, Portugal, and the UK. These countries were selected on the basis of the availability of economic and migration data for the entire study period in two international databases, Eurostat and the Organisation for Economic Co-operation and Development (OECD) Economic Outlook (8); this approach ensures the accessibility and comparability of the study data. Notably, Greece, Luxembourg, and Switzerland are not considered because fiscal data before 1990 are not available for these nations in the Economic Outlook database. The European countries that we consider receive most of the asylum applications

in Europe (89% in 2015); moreover, in contrast to certain Eastern European countries, the selected nations are almost never the home countries of the asylum seekers.

This study uses two variables related to international migration, both of which are constructed from Eurostat data. The first, the flow of asylum seekers, is measured as the number of first applications, pending at the end of the year, made by people who state that they are unable to return to their country of origin because of a well-founded fear of being persecuted. The lodging of an asylum application with a country entitles the applicant to reside legally in that country while the application is being processed but generally does not entitle the applicant to work and does not necessarily lead to being granted refugee status (9). We express flows of asylum seekers as rates per thousand inhabitants (based on average population).

The second variable is the net flow of migrants, which is measured using the net migration (plus adjustment) rate per thousand inhabitants. The net flow of migrants therefore includes all immigrants and does not distinguish between nationals and foreigners. Net migration data are produced by Eurostat from population statistics that exclude persons temporarily staying in a country and, most notably, asylum seekers. In methodological terms, this point is important because it emphasizes the fact that our two migration variables count different sets of people and thus are not mechanically correlated. When the asylum application procedure is completed, only applicants who obtain refugee status are allowed to settle long-term in their host countries; these individuals are then considered to be permanent migrants and included in population statistics. The population effects of flows of asylum seekers are thus postponed and potentially reduced because not all applicants obtain refugee status.

Descriptive statistics reveal considerable variations in migration flows across countries (see fig. S1): Certain countries (such as Austria and Sweden) have high flows of asylum seekers that are closely correlated with the net flows of migrants, whereas in other countries (such as Spain and Portugal), the flow of asylum seekers is much lower than the net flow of migrants. For a subset of countries, flows of asylum seekers peaked in the early 1990s because of the war in former Yugoslavia. More recently, the war in Syria induced a large increase in flows to certain countries but hardly altered flows to other nations.

We also examine how economic variables interact with the aforementioned migration variables. As considered in (10–16), we use real GDP per capita and unemployment rate to assess macroeconomic performance. In addition, we use the same indicators for public finances

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that are used in studies that measure the multiplier effects of fiscal shocks (*11–16*). Two main variables are considered: public spending (that is, general government final consumption and investment expenditures) and net taxes (that is, general government revenues minus transfers). These variables, obtained from the OECD Economic Outlook database, are expressed in real terms and divided by average population. Moreover, we also calculate fiscal balance by subtracting public spending from net taxes and dividing the resulting value by GDP (see the Supplementary Materials).

To assess the effects of net flows of migrants and asylum seekers on Western European economies, we have constructed and estimated a panel vector autoregressive (VAR) model. The VAR approach, which has been widely used in macroeconomics since (*17*), quantifies an economy's response to an exogenous structural shock (that is, the effects of an unusual external event on the economy). With an appropriate identification of the shocks based on economic theory, researchers have used this approach to assess the effects of economic policies (*18*), particularly fiscal policies (*11–16*). We consider that VAR modelling is an appropriate tool for analyzing the macroeconomic effects of migration shocks because it addresses reverse causality bias, which is present in this case because economic situations are both affected by immigration and likely to influence decisions to migrate. Researchers have previously used the VAR technique to examine the macroeconomic effects of immigration (*10, 19*) and to evaluate the effects of demographic changes (*20–23*). The innovative aspect of the present study is that it uses a panel VAR model to analyze the effects of immigration and asylum policies on public finances.

We differ therefore from purely accounting approaches, including both static (*2, 24*) and dynamic (*25, 26*) approaches, because our method includes interactions between variables and is not based on assumptions about the growth of economic variables. We also differ from approaches that use computable general equilibrium models (*27, 28*), which are based on strong theoretical assumptions, particularly regarding market equilibrium and restrictive production functions, and on key parameters that are not estimated. VAR ap-

proaches rely only on data and do not impose a theoretical model; these features are certainly appropriate for scientifically addressing sensitive topics such as immigration and asylum (*29*). A further advantage of VAR models is that they provide dynamic estimations of short- and medium-term effects of migration shocks.

Notably, given the time coverage of the data, it is not possible to provide an analysis specific to each country. Our findings are based on a panel of countries and assess the average responses of these countries to the analyzed shocks. The statistical model that we estimate is described in detail in the Supplementary Materials. The main assumption required for our analysis concerns the strategy for identifying shocks. We use the Cholesky decomposition and therefore impose an order on our variables, specifying which variables may be affected in period t by a modification of another variable during the same period. These assumptions relate to the contemporary effects of the examined shocks, and no restriction is placed upon the variables for dates after t.

We define this order based on the literature and verify that all our results are robust to order change. For economic and fiscal variables, much of the literature (*11–16*) uses the following order: public spending per capita, net taxes per capita, GDP per capita, and unemployment rate. A shock to public spending in year t may affect net taxes in year t, whereas a shock to net taxes in a particular year will not affect public spending in that year. Migration variables come before economic variables as in (*10*), reflecting the fact that migration decisions are reached before migrating and are therefore not affected by shocks to economies at the time of migration. Among migration variables, we have placed flow of asylum seekers before net flow of migrants, as part of the former is included in the latter once their applications for international protection are approved.

Our empirical strategy is as follows. We construct a model that can replicate recent findings in the literature concerning the economic effects of fiscal policies. We then analyze the economic and fiscal effects of migration shocks.

Table 1. Economic and fiscal Responses to migration shocks. Year 0 stands for the year of the shock. We set the size of a shock on the net flow of migrants or the flow of asylum seekers to 1 incoming individual per thousand inhabitants. For per capita, GDP, spending, and net taxes, we expressed the responses in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage point change.

	Year 0	Year 1	Year 2	Year 5	Year 10
Increase in the flow of asylum seekers					
Spending per capita	0.28	0.33	0.34	0.58	0.24
Net taxes per capita	0.57	0.63	1.01	1.31*	0.20
GDP per capita	0.27	0.45	0.54	0.59*	0.13
Unemployment rate	−0.08*	−0.15*	−0.21*	−0.21*	−0.02
Fiscal balance/GDP	0.06	0.07	0.15	0.15	−0.01
Increase in the net flow of migrants					
Spending per capita	0.29*	0.49*	0.60*	0.33*	−0.02
Net taxes per capita	0.85*	1.11*	0.95*	0.19	−0.09
GDP per capita	0.17*	0.24*	0.32*	0.12	−0.05
Unemployment rate	−0.12*	−0.16*	−0.14*	−0.03	0.01
Fiscal balance/GDP	0.11*	0.11*	0.05	−0.04	−0.02

*Statistical significance at the 10% level.

RESULTS AND DISCUSSION

We construct the model in two stages. First, we estimate a statistical model without the migration variables and analyze the economy's response to Keynesian stimulus shocks. For public spending shocks, our results are similar to those obtained in (30) and are particularly close to those reported in (12, 13, 15), in which 14 European countries are examined from 1970 to 2004. We then estimate the complete model, including flows of asylum seekers and net flows of migrants. To validate the model, we analyze the economy's response to the same Keynesian stimulus shocks (see the Supplementary Materials). We find that the economy's responses to public spending and tax shocks are similar in the models with and without migration variables. We can therefore use our model to analyze the macroeconomic effects of migration shocks.

The effects of a shock on the flow of asylum seekers and the net flow of migrants are indicated in Table 1, and the corresponding impulse response functions are reproduced in Fig. 1, which provides a graphical representation of these effects. These results show percentage responses to a one-point increase in migration flows. Our estimates indicate that these shocks have positive effects on European economies: They significantly increase per capita GDP, reduce unemployment, and improve the balance of public finances; the additional public expenditures, which is usually referred to as the "refugee burden," is more than outweighed by the increase in tax revenues. The effect of a shock on the net flow of migrants is positive from the year of that shock and remains significant for at least 2 years. An inflow of asylum seekers takes longer to significantly affect the economy; in particular, significant positive effects
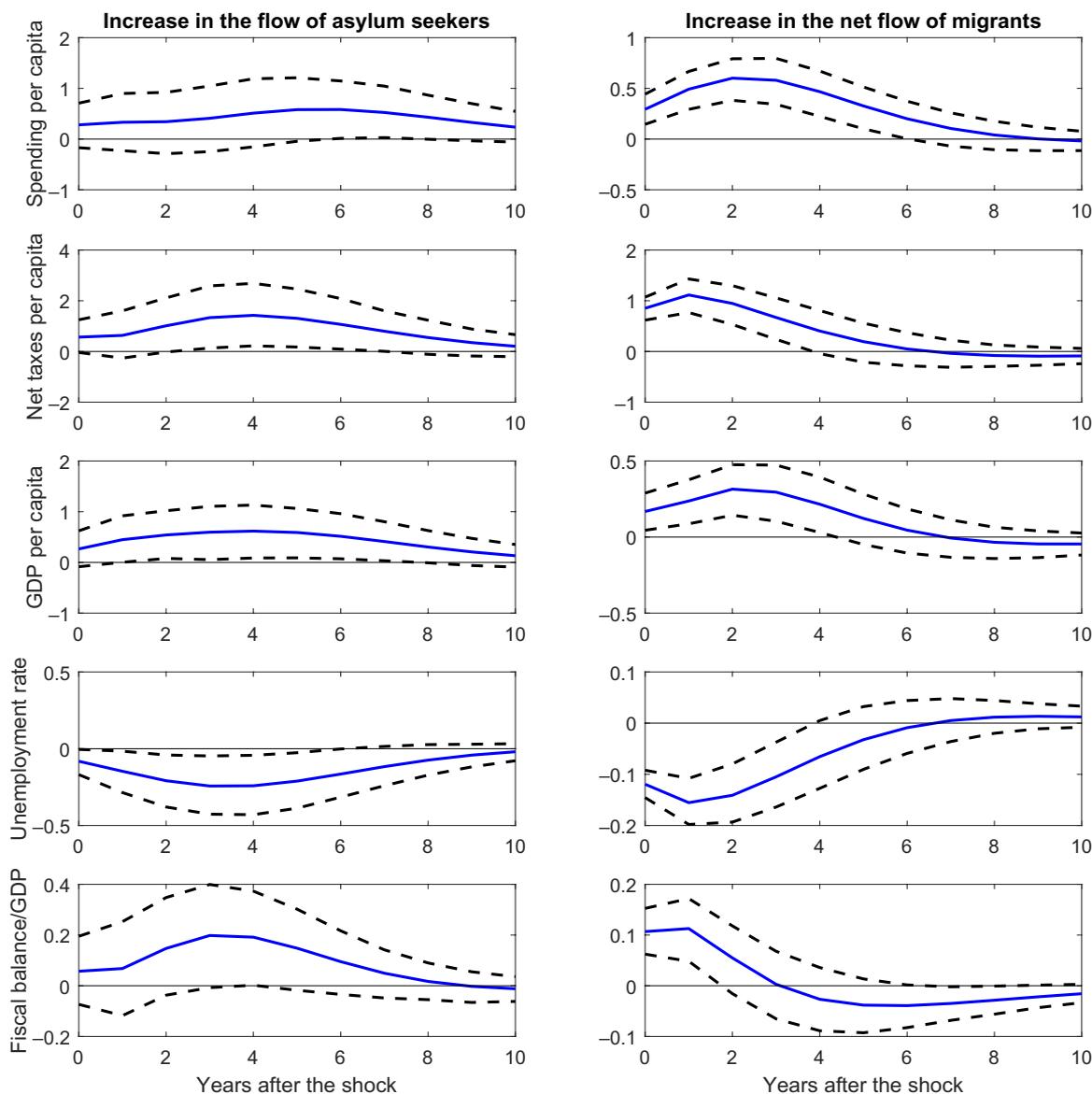

Fig. 1. Economic and fiscal responses to migration shocks. Year 0 stands for the year of the shock. We set the size of a shock on the net flow of migrants or the flow of asylum seekers to 1 incoming individual per thousand inhabitants. For per capita, GDP, spending, and net taxes, we expressed the responses in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage point change. The solid line gives the estimated impulse responses. The dashed lines give the 90% confidence intervals that are generated by 5000 Monte Carlo repetitions.

on GDP are observed from 3 to 7 years after this shock. The extents of the observed effects also differ: The effects of a shock on the net flow of migrants are strong. GDP per capita increases significantly for 4 years running, with an increase of +0.32% 2 years after the shock; the unemployment rate falls by roughly 0.14 percentage points 2 years after the shock; and fiscal balance improves by 0.11 percentage points at its peak, which occurs 1 year after the shock. In the Supplementary Materials (See "Relation to other studies"), we compare these estimates with those obtained in related studies. However, the corresponding effects of a shock on the flow of asylum seekers are less clear. This result might be attributable to the facts that only a subset of asylum seekers remain in their host country and asylum seekers can initially find it difficult to access the labor market due to legal restrictions (9).

We can also analyze the dynamic responses of migrations to their own shocks and the interdependence between the net flow of migrants and the flow of asylum seekers using our model. As shown in Table 2 and Fig. 2, both the flow of asylum seekers and the net flow of migrants respond somewhat persistently to their own shocks, with significant responses observed many years after a shock. Table 2 and Fig. 2 show that the dynamic effect of an asylum shock on the net flow of migrants is positive during the 6 years after the shock, a phenomenon that reflects the fact that certain asylum seekers become permanent migrants. Table 2 and Fig. 2 also indicate the effect of a shock to the net flow of migrants on the flow of asylum seekers. This effect is positive and significant 1 year after the shock, confirming that asylum seekers tend to travel toward countries open to immigration (31).

Our results are robust; in particular, these findings are not qualitatively altered when estimates are produced using alternative technical assumptions (such as an alternative order in the Cholesky decomposition, without considering contemporaneous cross-country interdependence, and an altered estimation period that excludes the recent alleged migrant crisis). See the Supplementary Materials for a detailed discussion.

Our results suggest that the alleged migrant crisis currently experienced by Europe is not likely to provoke an economic crisis but might
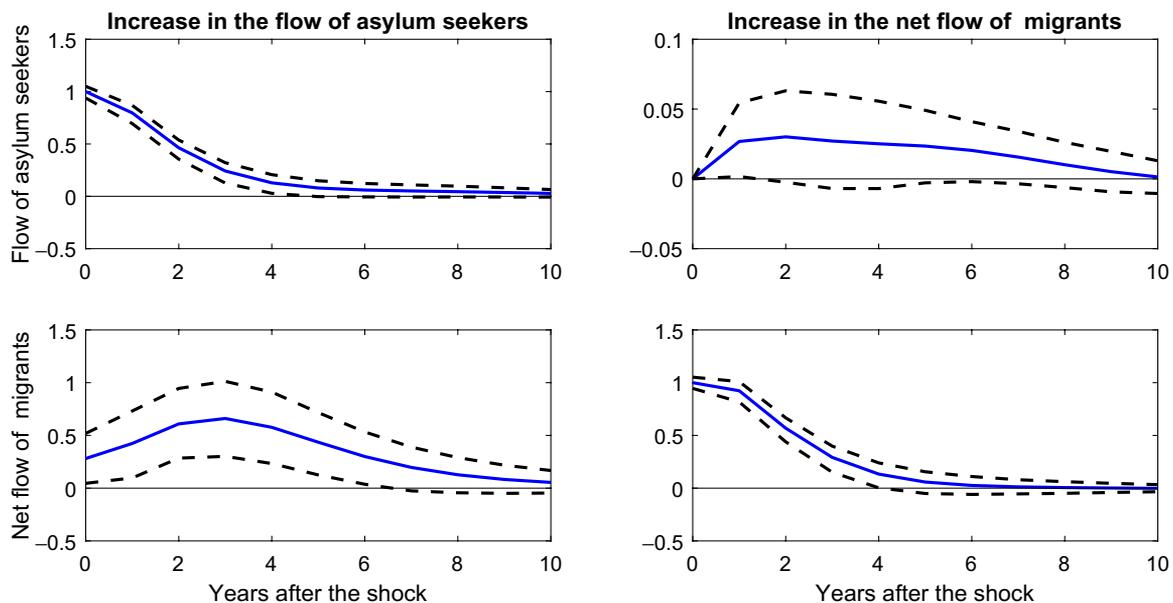
Table 2. Migration responses to migration shocks. Year 0 stands for the year of the shock. We set the size of a shock on the net flow of migrants or the flow of asylum seekers to 1 incoming individual per thousand inhabitants. We expressed the responses in per 1000 point change.

	Year 0	Year 1	Year 2	Year 5	Year 10
Increase in the flow of asylum seekers					
Flow of asylum seekers	1.00*	0.80*	0.46*	0.08*	0.03
Net flow of migrants	0.28*	0.42*	0.61*	0.44*	0.05
Increase in the net flow of migrants					
Flow of asylum seekers	0.00	0.03*	0.03	0.02	0.00
Net flow of migrants	1.00*	0.92*	0.57*	0.06	0.00

*Statistical significance at the 10% level.

Fig. 2. Migration responses to migration shocks. Year 0 stands for the year of the shock. We set the size of a shock on the net flow of migrants or the flow of asylum seekers to 1 incoming individual per thousand inhabitants. We expressed the responses in per 1000 point change. The solid line gives the estimated impulse responses. The dashed lines give the 90% confidence intervals that are generated by 5000 Monte Carlo repetitions.

rather be an economic opportunity. We do not deny that large flows of asylum seekers into Europe pose many political challenges both within host countries and with respect to the European coordination of national policies. However, these political challenges may be more easily addressed if the cliché that international migration is associated with economic "burden" can be dispelled. In particular, we believe that the allocation mechanism for asylum seekers should be more dependent on political and diplomatic considerations than on economic concerns.

MATERIALS AND METHODS
The migration variables are from Eurostat database. Precisely, we used the asylum applications pending at the end of the year from the Asylum and managed migration (migr) database, series codes migr_asyctz and migr_asyappctza. The data on the average population (series code AVG), used to express the flows of asylum per thousand inhabitants, were from the Population change (demo_gind) database. The net flow of migrants was measured by the CNMIGRATRT series from the Population change (demo_gind) database. The economic and fiscal data were from the OECD Economic Outlook database (8) and were computed, as in (12, 13, 15), by using the series codes listed in the Supplementary Materials.

Our empirical analysis was based on a panel VAR model estimated by using the bias-corrected fixed-effects technique (see the Supplementary Materials for details). We considered two models, a baseline model that aims at replicating the recent findings of the literature on spending shock and a second model that includes migration variables. The models were estimated in log levels, allowing for country-fixed effects, country-specific time trends, and year-specific effects. In the additional results section of the Supplementary Materials, we described the results of an alternative specification using log first differences of GDP, spending, and net taxes.

SUPPLEMENTARY MATERIALS
Supplementary material for this article is available at http://advances.sciencemag.org/cgi/content/full/4/6/eaaq0883/DC1

Supplementary Materials and Methods
Supplementary Results
fig. S1. Net flow of migrants and flow of asylum seekers in 15 European countries, 1985–2015, annual data.
fig. S2. Responses to fiscal shocks in baseline model.
fig. S3. Responses to fiscal shocks in baseline model using cyclically adjusted net taxes.
fig. S4. Responses to fiscal shocks in model including migration variables.
table S1. Summary statistics, averages per country over the sample period (1985–2015).
table S2. Responses to fiscal shocks.
table S3. Economic and fiscal responses to migration shocks, robustness analysis.
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Science Advances

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