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Supplementary Materials for

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

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Supplementary Materials and Methods

Data

We use freely available data from Eurostat on population statistics and asylum applicants and data from OECD Economic Outlook (*8*). The choice of the sample period was guided by the availability of the Eurostat data on annual asylum applications in 15 Western European countries from 1985 to 2015 at the time of this writing.

Migration variables

The first variable used to evaluate international migration is the flow of asylum seekers, which is measured by the first asylum applications pending at the end of the year. Asylum seekers are temporary migrants who are waiting for a decision on their asylum claims. While their application is being processed, asylum seekers have access to public services, such as education and health, and they receive conditional social transfers, but they are generally not allowed to work.

Second, we use the net flow of migrants, which is measured by the crude rate of net migration plus a statistical adjustment. Given that the growth of a country's population is the sum of natural increases (births minus deaths) and net migration (the total number of arrivals minus the departures of foreigners and nationals), the net migration data are produced by Eurostat as the difference between the total population change and the natural change. The population statistics do not include persons who are temporarily staying in the country. Short-term movements for tourism or business are excluded.

More importantly, foreigners who are applying for a first residence permit are not included.

Thus, asylum seekers are not considered to be a part of the “usual resident population” and they are not included in the population statistics that are used by Eurostat to produce net migration data. The Eurostat annual data on asylum applications cover persons whose claim has not been definitively evaluated at the end of the year. Therefore, for a given year, an asylum applicant that is computed in our flow of asylum seekers variable is not counted by Eurostat as a permanent migrant, and he or she is not included in our net flow of migrants variable for this given year.

Economic and fiscal variables

The economic and fiscal data are computed by using the following series codes from the OECD Economic Outlook database (*8*).

UNR: Unemployment rate

GDP: Gross domestic product, value, at market prices

PGDP: Gross domestic product, deflator

CGAA: Government final consumption expenditure

PCG: Government final consumption expenditure, deflator

IGAA: Government fixed capital formation.

PIGAA: Government fixed capital formation, deflator

SSPG: Social security benefits paid by the general government

SSRG: Social security contribution received by the general government

TIND: Taxes on production and imports

TOCR: Other current receipts, general government

TY: Total direct taxes

YPEPG: Property income paid by the government

YPERG: Property income received by the government

YPOTG: Other current outlays, general government.

The variables of interest are computed as follows :

Real GDP = GDP/PGDP

Real public spending = CGAA/PCG + IGAA/ PIGAA

Revenues = TIND + TY + SSRG + YPERG + TOCR

Transfers = SSPG + YPEPG + YPOTG

Real net taxes = (Revenues - Transfers)/PGDP

Note that these variables of interest are expressed in per capita terms by using the average population (AVG) from Eurostat.

We use annual data similar to (*12, 13, 15*), who emphasized their advantages in fiscal studies compared with quarterly data used in (*11, 14, 16*). The first reason for this use is that fiscal changes are generally decided in the Budget Act before the new fiscal year (while sometimes these changes are decided for mid-year budget revisions, but they are almost never determined quarterly); therefore, the estimated shocks from annual data can be considered good approximations of actual shocks (*15*). Second, potential issues that relate to the anticipation of fiscal policy changes can be neglected with annual data. Third, for many countries, the data on fiscal variables (and also international migration) are not generally available quarterly; for these countries, quarterly series are often interpolated from annual data.

Methods

Estimation methodology

First, we describe our estimation methodology. To obtain an adequate sample size by using annual data, similar to (*12, 13, 15*), our empirical analysis is based on a panel vector autoregressive (VAR) model with the following specification

$$
\begin{aligned}
Z_{it} &= A(L)Z_{it} + v_i + \lambda_i t + f_t + \varepsilon_{it} \\
&= \sum_{s=1}^{p} A_s Z_{it-s} + v_i + \varepsilon_{it} \; i = 1, ..., N \text{ and } t = 1, ..., T \qquad (1)
\end{aligned}
$$

where $Z_{it} = (z_{it}^1, ..., z_{it}^K)'$ is a $(K \times 1)$ vector of endogenous variables; A_s are the fixed $(K \times K)$ coefficient matrices of lag operator polynomial $A(L)$; $v_i = (v_i^1, ..., v_i^K)'$ is a fixed $(K \times 1)$ vector of individual effects; and $\varepsilon_{it} = (\varepsilon_{it}^1, ..., \varepsilon_{it}^K)'$ is the $(K \times 1)$ vector of residuals that satisfy $E(\varepsilon_{it}) = 0$, $E(\varepsilon_{it}\varepsilon_{it}') = \Omega$ for all i and t, and $E(\varepsilon_{it}\varepsilon_{j\tau}') = 0$ for $i \neq j$ or $t \neq \tau$.

In the dynamic panel models, the fixed effects estimator suffers from the well-known Nickell bias (*32*) for a finite time dimension T even when the cross-sectional dimension N is large. We therefore estimate our panel VAR (with $N = 15$ and $T = 31$) by using the bias-corrected fixed-effects technique of (*33*). This approach is suitable when T and N have comparable sizes, i.e., when $0 < \lim N/T < \infty$ (as here), and may be understood as an implementable version of Kiviet's bias-corrected fixed-effects estimator (*34*). In particular, the technique of (*33*) can be applicable to higher order VAR models by using the fact that any higher order VAR process can be rewritten in first-order VAR form, by imposing blockwise zero and identity restrictions (*33, 35*). Moreover, as shown in (*33*), the efficiency of a bias-corrected estimator often dominates that of the GMM estimator, in terms of the root mean squared error.

Estimating the model in panel form requires to assume cross-country homogeneity in the relations among the variables. To allow for this homogenous assumption, we rely on the 15 Western European countries that have many similarities. We also include country-fixed effects and country-specific time trends. Moreover, we remove cross-country contemporaneous interdependence by including year-specific effects.

Based on the Akaike information criterion (AIC) and Bayesian information criterion (BIC), we set the lag length of the system to two so that there is any serial correlation in the residuals. The results are robust to alternative lag lengths greater than two.

Replication of the literature on fiscal studies

As a first step, we ignore the migration variables and set up a model that aims at replicating the recent findings of the literature. To this end, we first consider a baseline structural VAR that consists of a set of endogenous variables $Z_{it} = (g_{it}, nt_{it}, y_{it}, u_{it})'$, where g is the real public spending per capita, nt is the real net taxes per capita , y is the real GDP per capita, and u is the unemployment rate. All variables are in natural logarithms. After detrending the variables (with country-specific linear trend), many panel unit root tests fail to accept the null hypothesis of the unit root. Therefore, we can set a VAR model that considers all the variables in levels while controlling for country heterogeneity (by using country-specific effects and country-specific time trends) and cross-country interdependence (by using year-specific effects). Following the literature on the fiscal multiplier that uses annual data (*12, 13, 15*), our identification is based on a lower-triangular Cholesky decomposition according to the following structural VAR

$$B_0 \begin{pmatrix} g_{it} \\ nt_{it} \\ y_{it} \\ u_{it} \end{pmatrix} = B(L) \begin{pmatrix} g_{it-1} \\ nt_{it-1} \\ y_{it-1} \\ u_{it-1} \end{pmatrix} + B_0 v_i + \begin{pmatrix} e^g_{it} \\ e^{nt}_{it} \\ e^y_{it} \\ e^u_{it} \end{pmatrix} \tag{2}$$

where $B_0 = \begin{pmatrix} -\beta^{gg} & 0 & 0 & 0 \\ -\beta^{ntg} & -\beta^{ntnt} & 0 & 0 \\ -\beta^{yg} & -\beta^{ynt} & -\beta^{yy} & 0 \\ -\beta^{ug} & -\beta^{unt} & -\beta^{uy} & -\beta^{uu} \end{pmatrix}$

where $e_{it} = (e^g_{it}, e^{nt}_{it}, e^y_{it}, e^u_{it})' = B_0\varepsilon_{it}$ stands for the vector of structural shocks that are mutually uncorrelated and $B(L)$ is a matrix polynomial in the lag operator L.

The identification assumption in equation (2) indicates that the variables listed earlier in the VAR order can impact other variables contemporaneously, while the variables listed later can impact the variables listed earlier only with a lag. Therefore, in our identification, public spending is allowed to contemporaneously impact net taxes, output and the unemployment rate, and responds to these variables only with a lag. This assumption is justified by the fact that changes in expenditures are generally decided in the Budget Act presented before the new fiscal year, while adjustments during the current year are negligible (*12, 13, 15*). Net taxes are allowed to contemporaneously influence output and the unemployment rate and may respond to output and the unemployment rate only with a lag. Net taxes include some components that are cyclically sensitive, but these components are discretionary and under the government's control, which implies that they are also determined in the Budget Act before the new fiscal year. Finally, because productivity shocks can contemporaneously impact unemployment, the output is listed before the unemployment rate, which is ordered last in the system.

The fiscal balance is expressed as a share of GDP: $(NT_t - G_t)/Y_t$, where Y, G and NT are the real GDP per capita, real public spending per capita and real net taxes per capita, respectively. Its response is computed as follows

$$\frac{NT_t}{Y_t}\left[\hat{NT} - \hat{Y}_t\right] - \frac{G_t}{Y_t}\left[\hat{G}_t - \hat{Y}_t\right]$$

where $\hat{Y}$, $\hat{G}$ and $\hat{NT}$ are the impulse responses of Y, G and NT respectively, and where the ratios G_t/Y_t and NT_t/Y_t are approximated by the overall sample mean.

For the baseline model, Fig. S2 displays the impulse responses to public spending strongly increases and net tax cut, while Table S2 (panel *a*) reports the effects for specific periods after the shock. The size of both fiscal shocks is equal to 1 percent of GDP. For per capita GDP, spending and net taxes, the responses are expressed in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage point change. The dashed lines give the 90 percent confidence intervals that are generated by 5,000 Monte Carlo repetitions.

As shown in Fig. S2 and Table S2 (panel *a*), in response to its own shock, public spending strongly increases by 3.88 percent on impact (which is the peak), and it dies out slowly. GDP increases significantly by 2.20 percent on impact (the peak), and the response remains significant until the fourth year after the shock. In response to a spending shock, the unemployment rate decreases significantly by -0.08 percentage points on impact, and the response becomes insignificant from the first year after the shock. Net taxes increase significantly by 2.54 percent on impact and by 2.31 percent after one year and respond significantly until the third year after the shock. As a result, the fiscal balance deteriorates significantly for three years and by -0.36 percent of GDP on impact (the peak).

Net taxes also respond strongly and persistently to their own shock by -4.91 percent on impact (the peak). In response to a cut in net taxes, public spending falls significantly and persistently from the first year after the shock by -0.55 percent and peaks at -1.57 percent the third year after the shock. It should be noted that a cut in net taxes leads to a significant decrease in GDP by -0.53 percent on impact and by -1.08 at the peak (after two years), as well as a significant increase in the unemployment rate by 0.19 percentage points on impact and by 0.36 percentage points at the peak (after two years). These results may appear to be counter-intuitive but were nevertheless found by (*30*) for the US economy during recessions. (*36*) provide a comprehensive discussion of the possible underlying mechanisms. We note that the recent SVAR literature (see, e.g., *14, 15, 30*) that studies the macroeconomic effects of fiscal policies focuses on government spending rather than on net taxes. Finally, in response to a cut in net taxes, the fiscal balance deteriorates significantly and persistently for four years and by -1.03 percent of GDP on impact (the peak).

Our results are robust to alternative specifications and in particular when considering cyclically adjusted net taxes. Because cyclically sensitive expenditure components are present in net taxes, some authors consider cyclically adjusted net taxes rather than unadjusted net taxes (*12, 13, 15*). We have re-estimated our VAR using cyclically adjusted net taxes as a robustness check. Cyclically adjusted net taxes are built by using the elasticity of each component of the revenues (direct taxes, indirect taxes, social security contributions received, property income received, and other current receipts) and transfers (social security benefits paid, property income paid, and other current outlays) with respect to output to purge each of these components of its cyclical part. Therefore, for each component j, we compute $R_{jt}^{CA} = R_{jt}(Y_t^T/Y_t)^{a_j}$ where R_{jt} is the unadjusted (or non cyclically adjusted) item, R_{jt}^{CA} is the cyclically adjusted item, Y_t^T is the trend in the real GDP, Y_t is the real GDP, and a_j is the elasticity of item j to the real GDP. The trend in the real GDP is computed separately for each country in the sample, by regressing the log of the real GDP on a constant, a linear trend and a quadratic trend. Elasticities a_j are country-specific and are taken from (*37*) to whom we refer the reader for more details on the construction of the elasticities. Using cyclically adjusted net taxes (with a country-specific cyclical adjustment) allows us to account for the cross-country heterogeneity in the response of net taxes to output variations and to directly capture the reaction of the fiscal authorities to expenditure shocks (*12, 15*).

With cyclically adjusted net taxes in the VAR, the response of unadjusted net taxes is $\hat{NT} = \hat{NT}^{CA} + \eta\hat{Y}_t$, where $\hat{NT}^{CA}$ is the impulse response of cyclically adjusted net taxes, and η is the elasticity of net taxes with respect to the real GDP. The value of η is set to 2.1, which is the average elasticity of net taxes with respect to the real GDP that is used in (*12, 13, 15*). Therefore, with cyclically adjusted net taxes, the response of the fiscal balance to GDP ratio is given by

$$\frac{NT_t}{Y_t}\left[\left(\hat{NT}^{CA} + \eta\hat{Y}_t\right) - \hat{Y}_t\right] - \frac{G_t}{Y_t}\left[\hat{G}_t - \hat{Y}_t\right]$$

The impulse response functions that use cyclically adjusted net taxes are reported in Fig. S3 and Table S2 (panel *b*). Similar to (*15*), we find that using cyclically adjusted net taxes instead of unadjusted items gives roughly the same impulse responses for all variables except net taxes (which was expected). In Fig. S2 and Table S2 (panel *a*), unadjusted net taxes respond positively to expenditure shock, because the positive effect on the output is transmitted to the cyclical component of net taxes. Conversely, Fig. S3 and Table S2 (panel *b*) report the negative response of cyclically adjusted net taxes to an expenditure shock. Notice that (*15*) find the same result, which they interpret as an attempt of the fiscal authorities to accompany expenditure increases with discretionary tax cuts to further stimulate the economy.

It is worth n oticing that elasticities of net taxes (a_j and η) are estimated; therefore cyclically-adjusted net taxes are less precisely measured. Because we are mainly interested in estimating the responses to migration shocks and because using cyclically adjusted net taxes is found to be immaterial, we thus use unadjusted net taxes in our extended VAR to avoid potential bias that might be induced by using estimated elasticities.

Including migration variables

To compute the responses to migration shocks, we consider an extended structural VAR that includes the net flow of migrants and the flow of asylum seekers as follows

$$B_0 \begin{pmatrix} as_{it} \\ m_{it} \\ g_{it} \\ nt_{it} \\ y_{it} \\ u_{it} \end{pmatrix} = B(L) \begin{pmatrix} as_{it-1} \\ m_{it-1} \\ g_{it-1} \\ nt_{it-1} \\ y_{it-1} \\ u_{it-1} \end{pmatrix} + B_0 v_i + \begin{pmatrix} e_{it}^{as} \\ e_{it}^{m} \\ e_{it}^{g} \\ e_{it}^{nt} \\ e_{it}^{y} \\ e_{it}^{u} \end{pmatrix} \quad (3)$$

where $B_0 = \begin{pmatrix} -\beta^{asas} & 0 & 0 & 0 & 0 & 0 \\ -\beta^{mas} & -\beta^{mm} & 0 & 0 & 0 & 0 \\ -\beta^{gas} & -\beta^{gm} & -\beta^{gg} & 0 & 0 & 0 \\ -\beta^{ntas} & -\beta^{ntm} & -\beta^{ntg} & -\beta^{ntnt} & 0 & 0 \\ -\beta^{yas} & -\beta^{ym} & -\beta^{yg} & -\beta^{ynt} & -\beta^{yy} & 0 \\ -\beta^{uas} & -\beta^{um} & -\beta^{ug} & -\beta^{unt} & -\beta^{uy} & -\beta^{uu} \end{pmatrix}$

and where as_{it} and m_{it} are the logarithms of (1+ the flow of asylum seekers as a share of the population) and of (1 + the net flow of migrants as a share of the population), respectively; and e_{it}^{as} and e_{it}^{m} are the corresponding structural shocks.

The identification restrictions in equation (3) imply that the net flow of migrants and the flow of asylum seekers can contemporaneously impact the economic variables and respond to them only with a lag. This assumption is justified by the fact that the decision to migrate is generally made considering previous years' economic conditions. Concerning the ordering between migration variables, the flow of asylum seekers is placed before the net flow of migrants because some asylum seekers (whose application will be approved) will enter the migration statistics later. The ordering between economic variables in the extended structural VAR is the same as in the baseline model.

As reported in Fig. S4 and Table S2 (panel *c*), the economy's responses to budget and fiscal shocks are similar in the models with and without migration variables. Therefore, our model can be used to analyze the macroeconomic effects of migration shocks.

The responses to the net flow of migrants and the flow of asylum seekers are reported in Fig. 1 and Table 1. We find that both the net flow of migrants and the flow of asylum seekers have no harmful consequences on economic and fiscal outcomes. To the contrary, our results show evidence that both the net flow of migrants and the flow of asylum seekers are beneficial to the host country. The effect of a shock on the net flow of migrants is positive from the year of this shock and remains significant for at least two years. The effect of the inflow of asylum seekers takes longer to have a significant impact on the economy. Significant positive effects are observed on the GDP from three to seven years after this shock.

The dynamic responses of migrations to their own shocks are displayed in Fig. 2 and Table 2. Both the net flow of migrants and the flow of asylum seekers respond with some degree of persistence to their own shocks, with significant responses during many years after the shock. More importantly, the net flow of migrants responds positively and significantly to an asylum shock between two and five years after the shock, which reflects the fact that some asylum seekers become permanent migrants.

Relation to other studies

The existing studies on the fiscal contribution of international migration are based on approaches that ignore the economic interactions and/or rely heavily on assumptions and modeling choices (see (*1*) and (*29*) for comprehensive reviews). We use in this paper a purely data-based approach that differs substantially from the approaches that have been previously used to assess immigration's fiscal effects.

Comparing estimates across studies is difficult because of the differences in the considered countries and periods considered and the differences in methodological approaches. Importantly, most previous studies of the fiscal effect of immigration consider all immigrants regardless of their period of arrival, i.e., the immigrant population rather than the flow of migrants. The notable exception is (*2*) who consider the immigrants who arrived in the United Kingdom between 2001 and 2011. According to (*1*), for the United States, static accounting studies that consider the immigrant population in 1993 find that the annual fiscal contribution is between -0.2 percent and +0.4 percent of GDP. Dynamic accounting studies (e.g., (*26*)) find a fiscal effect between -0.8 percent and 1.5 percent of GDP depending on the assumptions. Note that these estimates are taken from (*1*), who concludes that the fiscal effect of immigration is relatively small, within the range of ± 1 percent of GDP.

To compare the magnitude of our effects with the results derived from other approaches, we must consider the fact that the dynamic responses of the fiscal variables to a migration shock consider the dynamic response of migration to its own shock. To make a relevant comparison, we have to compute an average response by using the cumulative response over time. For instance, we computed the ratio of the cumulative response of the fiscal balance to GDP ratio to migration shock with respect to the cumulative response of migration to its own shock over 10 years. This value accounts for the response of asylum seeker flow to a net migration shock if these asylum seekers become permanent migrants. We obtained that a shock to the net flow of migrants that amounts to one percent of the population improves the fiscal balance to GDP ratio by 0.29 percent points and the GDP per capita by 4.35 percent over 10 years. These estimated effects are close to the values obtained in (*2*) and (*5*).

Using a static accounting approach, (*2*) investigate the net fiscal effect of immigration on the UK economy from 1995-2011. For comparability, we converted their results, reported in their Table 6, to a percentage of GDP by using national accounts for 2011. For their baseline scenario, which is according to the authors "likely to underestimate immigrants' net fiscal contributions", the recently arrived immigrants, which represent 7 percent of the UK population, have induced a positive fiscal contribution of 2 percent of GDP. The implied elasticity is thus close to our estimate. Interestingly, they find that the net fiscal contribution of both immigrant and native population stocks are negative, the former being larger in magnitude than the latter.

Using gravity-based predictors, (*5*) study the relation between immigration and income per person across 188 countries around 2000. They find that "a one percentage point increase in the immigration share in the population increases income per person by about 6%", which is slightly larger than our estimate for Western European countries.

The economic and fiscal contribution of a given asylum seeker is difficult to evaluate directly because an asylum shock induces a dynamic response of the net flow of migrants and the flow of asylum-seekers over time. Nevertheless, we find that as asylum seekers become permanent residents, their macroeconomic effects are positive.

Supplementary Results

We now provide various robustness checks of our results in many dimensions including sensitivity to alternative identification, ignoring common time effects and changing the sample period.

Alternative ordering

We begin our robustness analysis by checking the sensitivity to alternative ordering in the Cholesky decomposition. In this alternative decomposition, we place the net flow of migrants before the flow of asylum seekers but leave the ordering of the other variables unaltered. This alternative ordering is justified by the idea that migration networks may facilitate asylum applications and contemporary influence the flow of asylum seekers. For this alternative ordering, Table S3 (panel *a*) reports the impulse responses to shock on the net flow of migrants and the flow of asylum seekers for specific periods after the shock. The dynamic effects are similar to the results reported in Table 1.

Ignoring common time effects

In our main estimations, we include common time effects to account for cross-country contemporaneous interdependence. Using common time effects may nevertheless absorb the cross-country co-movement in structural shocks (*12*). Therefore, as a further robustness check, we eliminate the common time effects. The results shown in Table S3 (panel *b*) indicate that ignoring common time effects in the estimation does not alter our findings, except that there is an increase in the significance of the responses to a shock on the flow of asylum seekers. This result may reflect the cross-country co-movement in asylum seekers' shocks among EU countries.

Period heterogeneity

To investigate the time homogeneity assumption, we check whether our results differ across time. More precisely, we check whether our results hold when the recent "migrant crisis" that started with the Arab Spring is excluded. Asylum applications to Western European countries have increased steadily since 2011 and reached a peak in 2015. In addition to this change in scale, the recent period is also characterized by a change in the distribution by country of origin of asylum seekers. In particular, according to Eurostat data, Syrian asylum seekers accounted for 18 percent of the total applications, on average, from 2011-2015, whereas they represented 1 percent on average during the previous decade. This increase was compensated by a decline in the share of applications that came from other Asian countries except for Iraq and Afghanistan. Conversely, the share of applications that were made by citizens of Central and Eastern European countries (which were not member of the European Union) has been stable since 2000 and accounts for less than 20 percent of the total applications.

Thus, we estimate our model for the sub-period from 1985 to 2010. As shown in Table S3 (panel *c*), the dynamic responses to a shock on the net flow of migrants are similar to the results obtained above, while the responses to asylum demand shock become nonsignificant. These nonsignificant responses to asylum shock may be explained by the fact that the magnitude of asylum seeker flows was, on average, smaller from 1985 to 2010.

Using first differences

As mentioned above, there is some statistical evidence of trend-stationarity of our series. However, for GDP, spending and net taxes, one cannot strongly exclude the presence of a unit root.

To check the relatively short duration of GDP and fiscal responses to migration or asylum shocks, we estimate a new VAR model with the first differences of the logarithms of per capita GDP, spending and net taxes. Cointegration relationships cannot be excluded and one candidate is the relation between net taxes and spending, under the assumption that the two variables follow a unit root process. Therefore, as in (*11*), to account for sustainability criteria imposed on fiscal policy (what are particularly relevant in Europe), we impose a co-integration relationship between spending and taxes so that the difference between the log of net taxes and the log of public spending is stationary that is given by their difference ($nt_t - g_t$), i.e., the stationarity of the logarithm of the net tax to spending ratio. The other variables enter in log levels, because they are strongly not integrated (using the first difference of an integrated variable may lead to a loss of information when a cointegration relation exists). Therefore, the VAR in this new specification consists of the following $(as_t, m_t, \Delta g_t, \Delta nt_t, \Delta y_t, u_t)'$ and includes the error correction $nt_{t-1} - g_{t-1}$.

The results are reported in Table S3 (panel *d*). To be consistent with the previous presentations of the results, we report the cumulative responses to shocks of series that enter in first difference (GDP, spending and net taxes). The responses to a net migration shock in this specification are very similar to our previous results, with a slightly larger response in the fiscal balance. As above, the effects of the asylum seekers' shock are significant with a delay, but are more persistent for GDP, spending and net taxes.

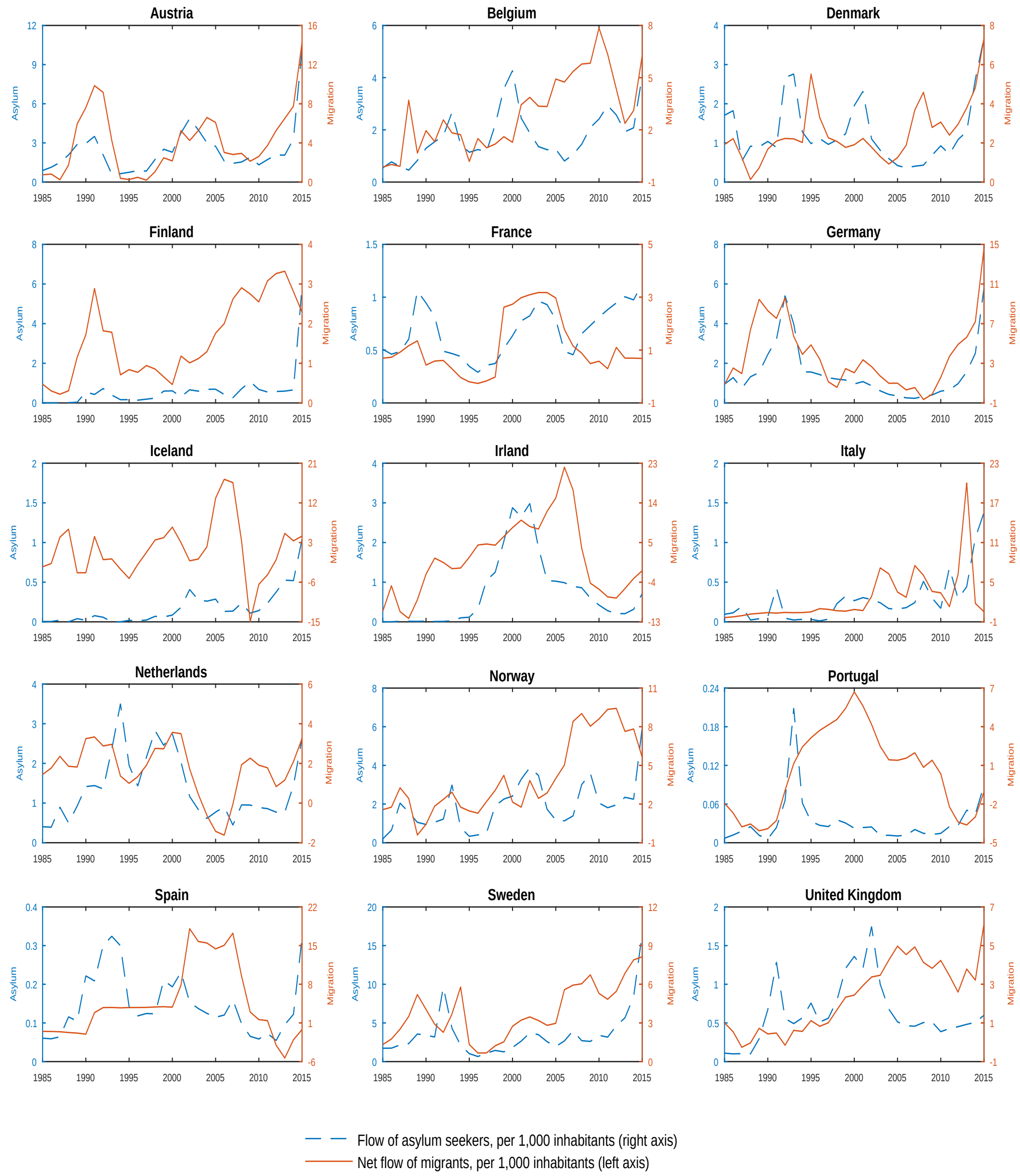

fig. S1. Net flow of migrants and flow of asylum seekers in 15 European countries, 1985–2015, annual data.

Source: Authors' computations based on data from Eurostat (`http://ec.europa.eu/eurostat/data/database`).

table S1. Summary statistics, averages per country over the sample period (1985–2015).

Country	Flow of asylum seekers (per 1,000)	Net flow of migrants (per 1,000)	GDP per capita (PPP, 2010 US$)	Unemployment rate (in %)	Spending per capita (PPP, 2010 US$)	Net Taxes per capita (PPP, 2010 US$)	Fiscal Balance to GDP ratio (in %)
Austria	2.35	4.06	36233	4.31	8124	6701	-4.00
Belgium	1.76	2.93	34988	8.26	8506	7126	-4.33
Denmark	1.27	2.52	39218	6.02	11014	9815	-3.19
Finland	0.60	1.61	32723	9.23	8494	7787	-2.18
France	0.68	1.14	32595	8.79	8741	6776	-5.99
Germany	1.51	3.79	35210	7.38	7335	6251	-3.11
Iceland	0.17	1.46	33951	3.64	8926	5841	-8.98
Ireland	0.74	1.42	34301	10.8	6739	5447	-4.05
Italy	0.27	2.56	32910	9.43	7249	4935	-7.33
Netherlands	1.38	1.73	38244	6.27	10377	8323	-5.44
Norway	1.92	4.07	51031	3.76	12495	17791	9.69
Portugal	0.03	0.47	23705	7.78	5288	3397	-7.93
Spain	0.15	4.56	27641	15.8	6049	4626	-5.20
Sweden	3.54	3.86	35339	6.94	10581	9720	-2.64
United Kingdom	0.63	2.36	31565	7.36	6813	5688	-3.48
All countries	1.13	2.57	34644	7.71	8449	7348	-3.88

Source: Authors' computations based on data from Eurostat (`http://ec.europa.eu/eurostat/data/database`) and and OECD Economic Outlook database (`https://stats.oecd.org/index.aspx?DataSetCode=EO`).

table S2. Responses to fiscal shocks.

	(a) Baseline Model				
	Year 0	Year 1	Year 2	Year 5	Year 10
Spending increase					
Spending per capita	3.88*	3.27*	2.29*	0.69*	0.01
Net taxes per capita	2.54*	2.31*	1.70*	0.47	-0.13
GDP per capita	2.20*	1.79*	1.18*	0.23	-0.08
Unemployment rate	-0.08*	-0.08	-0.07	-0.03	0.01
Fiscal balance/GDP	-0.36*	-0.28*	-0.18*	-0.07	-0.03
Net tax cut					
Spending per capita	0.00	-0.55*	-1.25*	-1.33*	-0.11
Net taxes per capita	-4.91*	-4.84*	-4.15*	-1.66*	0.22
GDP per capita	-0.53*	-0.89*	-1.08*	-0.65*	0.12
Unemployment rate	0.19*	0.32*	0.36*	0.17*	-0.04
Fiscal balance/GDP	-1.03*	-0.89 *	-0.58*	-0.03	0.08
	(b) Baseline Model, using Cyclically Adjusted Net Taxes				
	Year 0	Year 1	Year 2	Year 5	Year 10
Spending increase					
Spending per capita	3.88*	3.10*	1.79*	0.57*	0.23
Cycl. adj. net taxes per capita	-2.71*	-0.60*	0.85*	0.90*	0.33
GDP per capita	2.17*	1.62*	0.82*	0.14	0.04
Unemployment rate	-0.06*	-0.04	-0.01	0.01	-0.01
Fiscal balance/GDP	-0.51*	-0.14	0.11	0.10	0.03
Net tax cut					
Spending per capita	0.00	-0.48*	-1.08*	-1.18*	-0.45*
Cycl. adj. net taxes per capita	-4.90*	-4.02*	-2.83*	-1.55*	-0.59*
GDP per capita	0.07	-0.31*	-0.64*	-0.57*	-0.10
Unemployment rate	0.10*	0.17*	0.21*	0.14*	0.01
Fiscal balance/GDP	-0.96*	-0.84*	-0.61*	-0.29*	-0.05
	(c) Model including Migration Variables				
	Year 0	Year 1	Year 2	Year 5	Year 10
Spending increase					
Spending per capita	3.88*	3.15*	2.11*	0.60*	0.04
Net taxes per capita	2.31*	2.00*	1.44*	0.44	-0.07
GDP per capita	2.21*	1.72*	1.07*	0.19	-0.06
Unemployment rate	-0.04	-0.03	-0.03	-0.03	0.01
Fiscal balance/GDP	-0.41*	-0.31*	-0.19*	-0.06	-0.03
Net tax cut					
Spending per capita	0.00	-0.47*	-1.14*	-1.34*	-0.18
Net taxes per capita	-4.91*	-4.70*	-4.06*	-1.68*	0.07
GDP per capita	-0.58*	-0.91*	-1.04*	-0.68*	0.04
Unemployment rate	0.14*	0.27*	0.32*	0.17*	-0.02
Fiscal balance/GDP	-1.03*	-0.89*	-0.59*	-0.03	0.06

Notes. Year 0 stands for the year of the shock. The size of both spending and tax shocks is equal to 1 percent of GDP. * denotes statistical significance at the 10% level. For per capita GDP, spending and net taxes, the responses are expressed in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage points change.

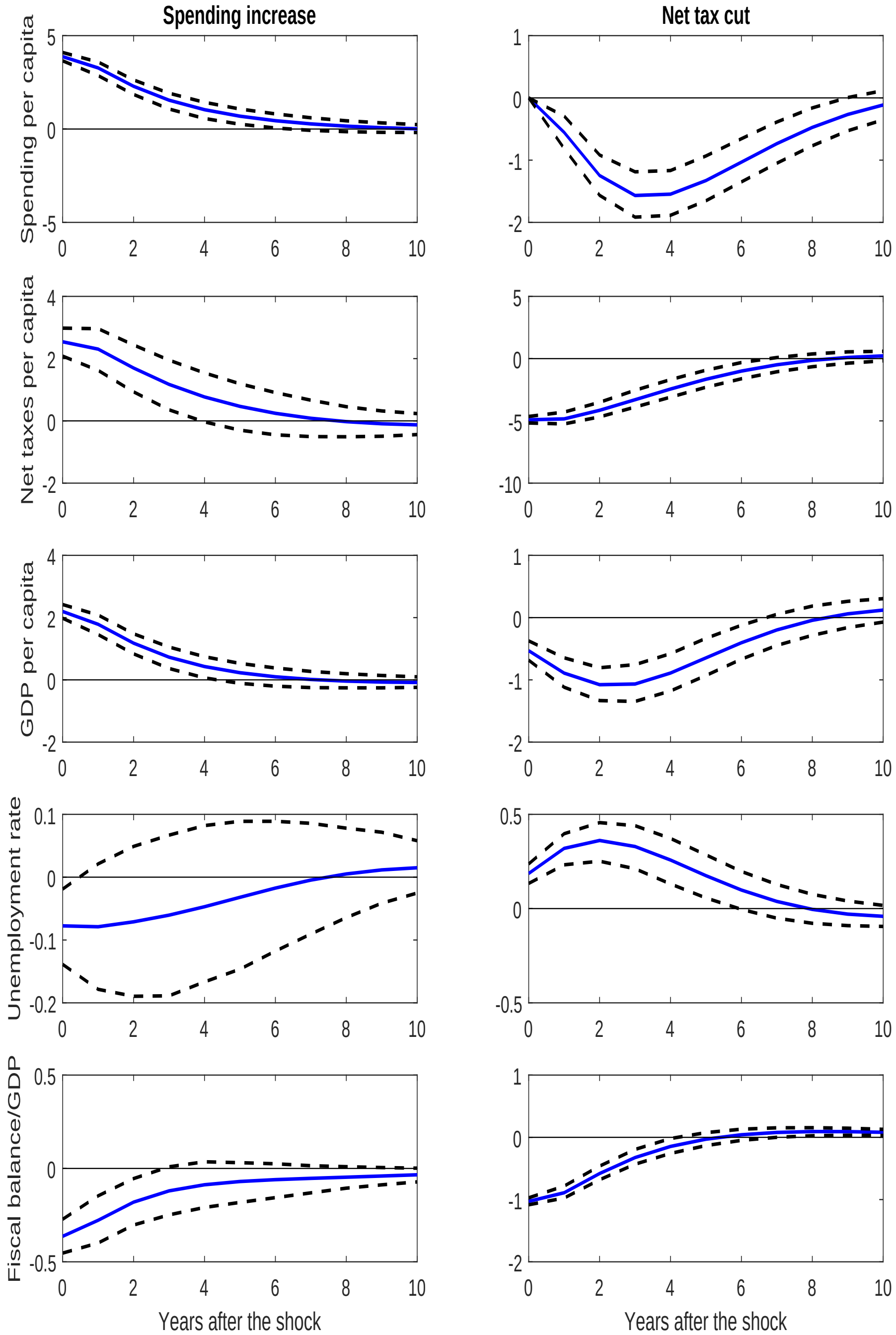

fig. S2. Responses to fiscal shocks in baseline model.

Year 0 stands for the year of the shock. The size of both spending and tax shocks is equal to 1 percent of GDP. For per capita GDP, spending and net taxes, the responses are expressed in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage points change. The solid line gives the estimated impulse responses. Dashed lines give the 90% confidence intervals that are generated by 5,000 Monte Carlo repetitions.

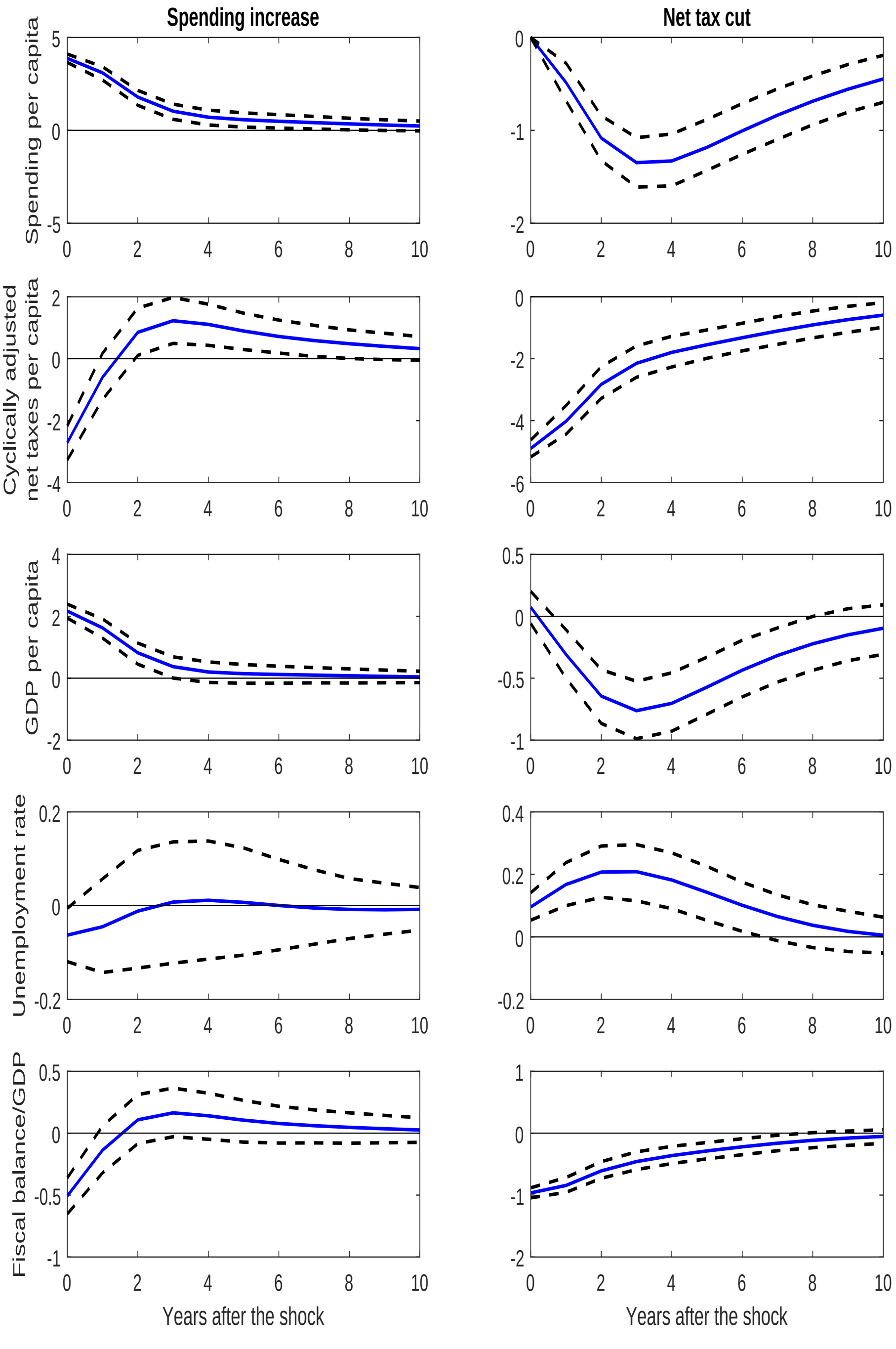

fig. S3. **Responses to fiscal shocks in baseline model using cyclically adjusted net taxes.**

Year 0 stands for the year of the shock. The size of both spending and tax shocks is equal to 1 percent of GDP. For per capita GDP, spending and net taxes, the responses are expressed in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage points change. The solid line gives the estimated impulse responses. The dashed lines give the 90% confidence intervals that are generated by 5,000 Monte Carlo repetitions.

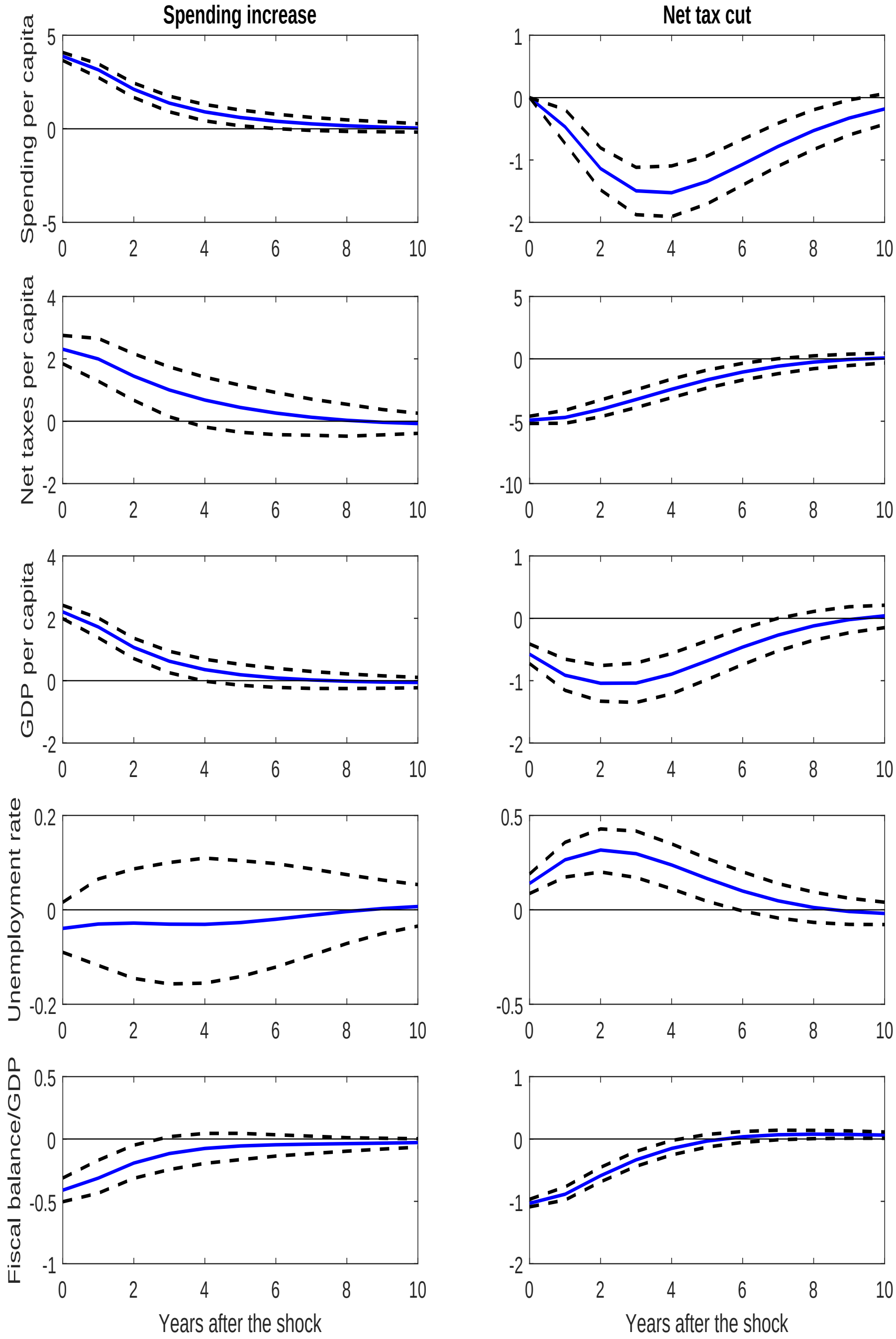

fig. S4. Responses to fiscal shocks in model including migration variables.

Year 0 stands for the year of the shock. The size of both spending and tax shocks is equal to 1 percent of GDP. For per capita GDP, spending and net taxes, the responses are expressed in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage points change. The solid line gives the estimated impulse responses. The dashed lines give the 90% confidence intervals that are generated by 5,000 Monte Carlo repetitions.

table S3. Economic and fiscal responses to migration shocks, robustness analysis.

	Year 0	Year 1	Year 2	Year 5	Year 10
	(a) Net flow of migrants before flow of asylum seekers				
Increase in the flow of asylum seekers					
Spending per capita	0.20	0.19	0.17	0.49	0.24
Net taxes per capita	0.33	0.32	0.75	1.25*	0.23
GDP per capita	0.22	0.38	0.45	0.56*	0.14
Unemployment rate	-0.05	-0.10	-0.17	-0.20*	-0.02
Fiscal balance/GDP	0.03	0.04	0.13	0.16	-0.01
Increase in the net flow of migrants					
Spending per capita	0.30*	0.50*	0.61*	0.34*	-0.01
Net taxes per capita	0.86*	1.12*	0.97*	0.23	-0.08
GDP per capita	0.18*	0.25*	0.33*	0.14	-0.04
Unemployment rate	-0.12*	-0.16*	-0.15*	-0.04	0.01
Fiscal balance/GDP	0.11*	0.11*	0.06	-0.03	-0.02
	(b) Ignoring common time effects				
	Year 0	Year 1	Year 2	Year 5	Year 10
Increase in the flow of asylum seekers					
Spending per capita	0.06	0.31	0.70*	1.30*	0.70*
Net Taxes per capita	0.24	-0.11	0.56	2.64*	0.93*
GDP per capita	0.07	0.14	0.60	1.39*	0.56*
Unemployment rate	-0.06	-0.05	-0.05	-0.17	-0.05
Fiscal balance/GDP	0.04	-0.10	-0.03	0.28*	0.04
Increase in the net flow of migrants					
Spending per capita	0.30*	0.53*	0.69*	0.46*	0.00
Net taxes per capita	1.17*	1.69*	1.42*	0.15	-0.04
GDP per capita	0.26*	0.40*	0.47*	0.16	-0.03
Unemployment rate	-0.14*	-0.20*	-0.19*	-0.02	0.02
Fiscal balance/GDP	0.17*	0.23*	0.14*	-0.08	-0.01
	(c) Period 1985-2010				
	Year 0	Year 1	Year 2	Year 5	Year 10
Increase in the flow of asylum seekers					
Spending per capita	0.10	0.24	0.27	0.33	0.14
Net taxes per capita	0.49	0.72	1.16	0.81	0.25
GDP per capita	0.44	0.54	0.60	0.46	0.13
Unemployment rate	-0.09	-0.15	-0.17	-0.06	-0.02
Fiscal balance/GDP	0.10	0.11	0.20	0.10	0.02
Increase in the net flow of migrants					
Spending per capita	0.31*	0.60*	0.54*	-0.13	0.04
Net taxes per capita	1.08*	1.39*	0.93*	-0.35	0.06
GDP per capita	0.22*	0.32*	0.31*	-0.08	0.02
Unemployment rate	-0.15*	-0.19*	-0.12*	0.07*	-0.01
Fiscal balance/GDP	0.15*	0.15*	0.07	-0.04	0.00
	(d) Using first difference				
	Year 0	Year 1	Year 2	Year 5	Year 10
Increase in the flow of asylum seekers					
Spending per capita	0.16	0.53	0.80*	1.09*	1.18*
Net taxes per capita	0.05	-0.22	0.56	2.38*	1.11*
GDP per capita	0.27	0.41	0.64*	1.11*	0.91*
Unemployment rate	-0.05	-0.03	-0.02	-0.14	-0.02
Fiscal balance/GDP	-0.02	-0.16	-0.06	0.26*	-0.03
Increase in the net flow of migrants					
Spending per capita	0.13	0.28*	0.31*	0.17	0.03
Net taxes per capita	1.01*	1.47*	1.14*	-0.08	-0.05
GDP per capita	0.17*	0.27*	0.26*	-0.02	-0.07
Unemployment rate	-0.14*	-0.21*	-0.21*	-0.03	0.03
Fiscal balance/GDP	0.18*	0.24*	0.17*	-0.06	-0.02

Notes: Year 0 stands for the year of the shock. The size of a shock on the net flow of migrants or the flow of asylum seekers is set to 1 incoming individual per thousand inhabitants. For per capita GDP, spending and net taxes, the responses are expressed in percentage change; for the unemployment rate and fiscal balance/GDP, the responses are in percentage point change. * denotes statistical significance at the 10% level.