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Identifying macroeconomic effects of refugee migration to Germany

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Abstract

This study investigates impacts of migration on the German economy, explicitly distinguishing refugee and non-refugee immigration. We propose a macroeconometric modelling approach complemented by instrumental variable techniques. We find that non-refugee immigration has more beneficial medium-run effects on GDP and the labour market.

Zusammenfassung

Diese Studie untersucht ökonomische Effekte der Immigration nach Deutschland, wobei explizit zwischen der Einwanderung Asylsuchender und sonstiger Einwanderung unterschieden wird. Wir schlagen einen makroökonometrischen Modellansatz mit Verwendung von Instrumentvariablen vor. In der mittleren Frist hat die Immigration Nichtasylsuchender einen günstigeren Effekt auf BIP und Arbeitsmarkt.

JEL classification: F22, E24, C32, C36.

Keywords: Immigration, economic effects, macroeconometric modelling, instrumental variables

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1 Introduction

The recent five years witnessed a strong upsurge in migration to Germany. Immigration from Southern and Eastern Europe due to the European economic crisis was added by refugees from the Middle East and other regions. In view of the high number of migrants, the discussion on economic consequences gains momentum all throughout Europe. However, still little is known about the macroeconomic effects of different types of immigration. Particularly, refugees naturally differ from other migrants in several aspects such as a decisive role of concrete push factors (Ruist 2013), no sorting e.g. with regard to labour market needs of the host country, specific institutional regulations, need of immediate support and special prospects for the duration of stay (compare Cortes 2004).

Against this backdrop, the underlying study investigates migration impacts on the German economy, explicitly distinguishing refugee immigration (RI) and non-refugee immigration (NRI). It contributes to the macroeconometric modelling of migration effects (e.g. Boubtane/Coulibaly/Rault 2013; Damette/Fromentin 2013; Kiguchi/Mountford 2013), introducing an instrumental variables (IV) identification of shocks into a structural vector autoregressive (SVAR) setting estimated by frequentist shrinkage techniques. This measurement approach combines the advantages of very generally taking into account comprehensive macroeconomic effects and interactions of migration shocks while being based on a minimal set of identifying assumptions. Furthermore, data requirements are low, whereas broad micro data on RI to Germany are not available. Inference does not rely on a priori specification of specific structures, e.g., regarding wage behaviour or complementarity relations. On the downside, interpretations can be less clearly guided by explicit economic mechanisms. Thus, our study should be seen as complementing approaches such as those based on structural equilibrium modelling or regional variation (e.g. Borjas 2003, 1999; for Germany Pischke/Velling 1997; D'Amuri/Ottaviano/Peri 2010; Brücker et al. 2014).

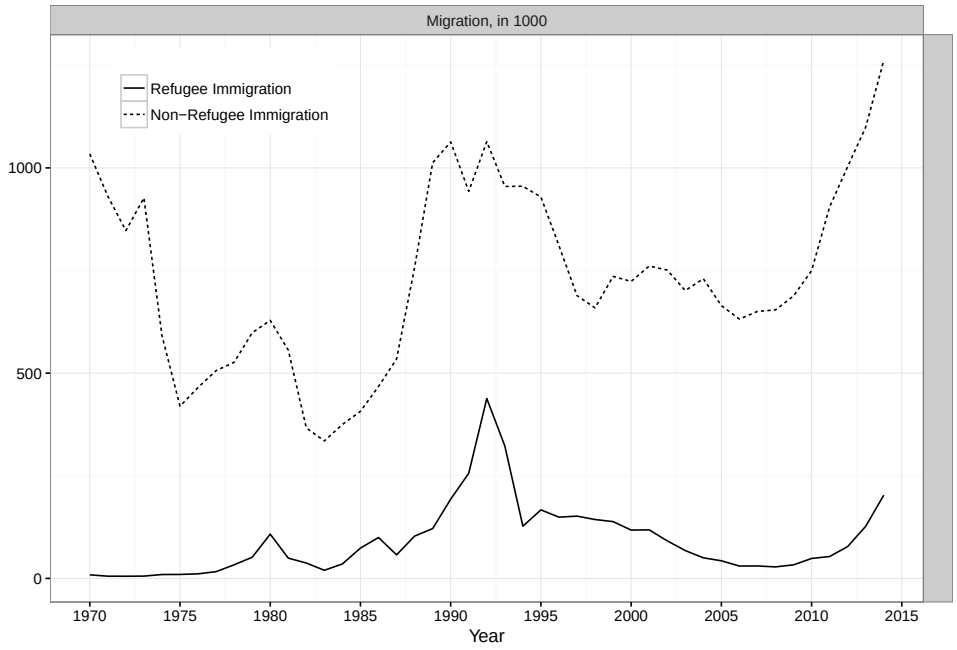
The next section introduces our data, followed by a description of the model and the identification methods. Section 4 discusses the resulting impulse responses and the last section concludes.

2 Data

We employ yearly German data for the period 1970-2014. We focus on gross rather than net immigration since recorded outflows are subject to substantial measurement errors and cannot be distinguished according to refugee status. While migration statistics by reason of immigration are not available, RI is proxied by the number of asylum applications from the Federal Office for Migration and Refugees.[1] Even though there were substantial delays in 2015, immigration and application usually fall within the same year. Moreover, since refugees occasionally continue their journey to third countries, an application in Germany signals that the immigration will be relevant to the German economy. NRI is given by

[1] Quota refugees, which are predominantly Jewish immigrants from former Soviet countries, are not contained in this measure, but are part of the overall immigration. Yearly numbers usually remain low.

Figure 1: Refugee immigration and non-refugee immigration to Germany.



Sources: Federal Office for Migration and Refugees, destatis.

the overall gross immigration from destatis, which also explicitly contains immigration of asylum-seekers, minus RI. Figure 1 shows the two variables.

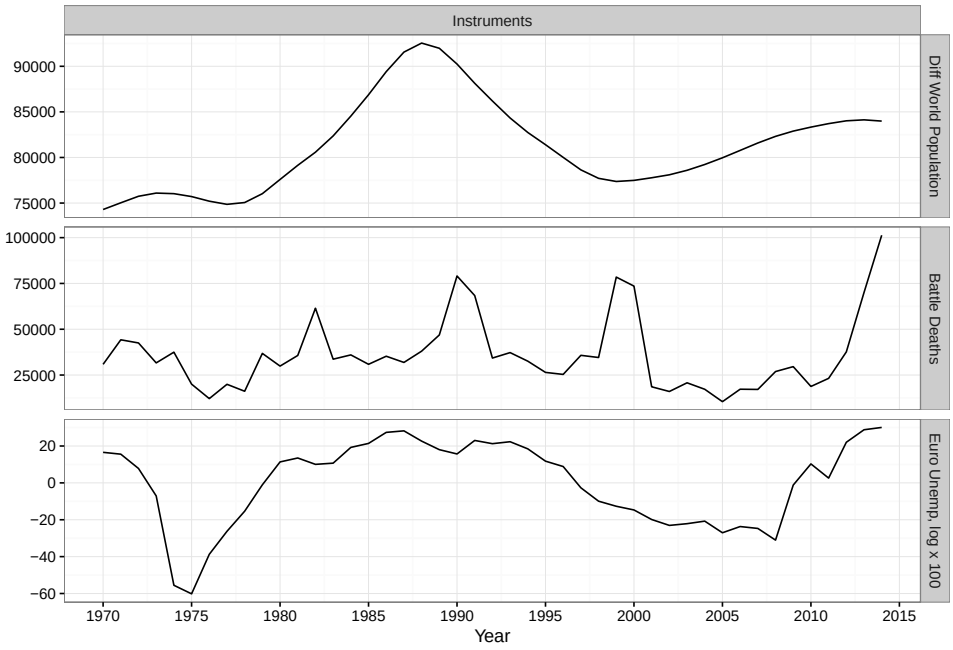
While the decline of immigration during the 1970s and 1980s following the oil price shocks was due to tightening migration restrictions, the increase in the 1990s resulted from the collapse of the Eastern European communist regimes and the civil wars in Yugoslavia for RI. Then, immigration slowed down due to economic slack and tighter restrictions, before the current migration wave started with the European economic and the refugee crisis.

The variables representing the macroeconomy are log real GDP, the wages share (gross wages divided by GDP) as well as the unemployment rate, all from destatis. GDP is divided by working-age population. RI and NRI are per capita of total population. Finally, all variables are multiplied by 100. To account for the German reunification, the West-German pre-unification series of GDP, wages and population are proportionally adjusted to match the German figure of 1991, where an overlap exists.

In order to avoid biases from endogeneity, we employ an IV approach with push factors for migration. World (less German) population from the UN World Population Prospects serves as a general instrument for migration. To gain an instrument specifically for RI, we make use of the UCDP Battle-related Deaths Dataset, Version 5.0-2015[2] that provides the number of deaths resulting directly from violence in armed conflicts with at least one national government involved. Conflicts in America are considered irrelevant for German immigration and are therefore dropped. For NRI, the standard migration literature (compare Hatton 1993) sees labour market conditions as a typical determinant. As an instrument,

[2] See `http://www.pcr.uu.se/research/ucdp/datasets/ucdp_battle-related_deaths_dataset/`. The dataset is extended back to 1970 using older data from the PRIO dataset, version 3; see Lacina/Gleditsch (2005).

Figure 2: Instruments: change in world population, battle-related deaths (without America), European unemployment (corrected for German unemployment).



Sources: UN World Population Prospects, UCDP Battle-related Deaths Dataset, ILO and own calculations.
Notes: The annual changes in world population are in 1000 persons, the corrected European unemployment is in natural logarithms, multiplied by 100.

we use unemployment in Europe[3], filtered by an orthogonal projection on the German unemployment rate, which accounts for international cyclical linkages. The IVs are displayed in Figure 2.

Auxiliary regressions of RI and NRI on the three instruments (as well as an autoregressive lag, a constant and a linear trend) delivered F-statistics for the IVs of 13.5 and 9.3, respectively, where battle deaths lagged two periods provided the best fit. Indeed, it turned out that the battle deaths are only relevant for RI, while unemployment only affects NRI. Thus, we have separate instruments of sufficient strength available.

3 Model and Identification

We proceed in a SVAR framework that allows measuring structurally identified shocks and dynamic interactions. The vector y consists of RI, NRI as well as the block of macroeconomic variables GDP, wage share and unemployment rate. x holds the instruments in first differences.

$$Ay_t = C_1 + C_2 t + \sum_{i=1}^{p} B_i y_{t-i} + Dx_t + \varepsilon_t \tag{1}$$

The matrix A (with diagonal elements normalised to one) contains the mutual contemporaneous spillovers, the dynamic interaction is covered by the lag coefficients in B_i,

[3] We aggregated unemployment figures from the ILO database of those (18) countries with data availability since the 1970s. Usually, this concerns registered unemployment.

$i = 1, \ldots, p$. D holds the coefficients of the instruments in the first rows and zeros else. C_1 is a vector of constants, C_2 a vector of time trend coefficients and ε includes the shocks. Besides, we consider impulse dummies in the GDP equation for the extreme observation in 2009 and the reunification in 1991.

An analysis of residual autocorrelation and information criteria showed that $p = 3$ lags are sufficient to capture the system dynamics. All endogenous variables are included in levels in order to avoid imposing unit roots by differencing. In a VAR with sufficient lag length, this allows for flexible formation of quasi differences or level relations.

The migration shocks are identified by IVs that exert direct effects on RI (except European unemployment) and NRI (except battle deaths), but are not directly linked to the other innovations. No further identifying restrictions need to be imposed, i.e., all bidirectional contemporaneous spillovers between the migration and macroeconomic variables are identified through the IV approach. However, for a priori reasons, we exclude contemporaneous effects of the macroeconomic variables on RI, which also would not turn out to be significant (p-value of a LR-test 0.988).

The estimates of the direct spillovers would be distorted if RI and NRI are subject to common factors. However, since both variables are separately instrumented, we can allow for correlation of their shocks. This corresponds to typical simultaneous systems and comes in addition to bilateral contemporaneous impacts. Furthermore, the innovations within the block of the macroeconomic variables are allowed to be correlated, since our research question does not require identification here.

To reduce the estimation variance in our richly parameterized model we estimate the SVAR using a ridge penalty approach, proceeding in two steps. In the first step, to estimate the reduced form for a given regularization parameter λ, we re-scale the data to achieve unit residual variance in each equation. The observations are stacked to their single-equation form, so that the cross-equation correlations are ignored for the reduced form estimates analogously to unpenalized OLS estimation. The ridge regression is estimated using the `glmnet` package in R (Friedman/Hastie/Tibshirani 2010). Coefficients on deterministic terms and exogenous instruments are exempt from shrinkage, while also coefficients on the first own lags of the endogenous variables remain unpenalized to prevent unnecessarily strong restrictions on the persistence of the series. Analogously to Bayesian VAR estimation in the spirit of Litterman (1986), a factor j^2 on the j'th lag of y_t increases the shrinkage parameter to penalize higher lag coefficients more heavily.

From the reduced form estimates, we compute the lag adjusted series $\check{y}_t = y_t - \hat{\Pi}_1 y_{t-1} - \ldots - \hat{\Pi}_p y_{t-p}$ where $\hat{\Pi}_j$ are reduced form coefficients on y_{t-j} from the first step, and adjust both $\check{y}_t$ and x_t for deterministic terms by least squares to obtain $\tilde{y}_t$ and $\tilde{x}_t$. From the latter series, we construct a penalized likelihood function

$$-\frac{T}{2}\log|A^{-1}\Sigma_\epsilon(A^{-1})'| - \frac{1}{2}\sum_{t=1}^{T}(\tilde{y}_t - A^{-1}C\tilde{x}_t)'(A'\Sigma_\epsilon^{-1}A)(\tilde{y}_t - A^{-1}C\tilde{x}_t) - \lambda\sum_{i\neq j}A_{ij}^2,$$

which is maximized to obtain estimates of A, C and Σ_ϵ in a second step. The regularization

parameter is estimated by 10-fold cross validation on coherent blocks of the sample, based on the reduced form and a mean squared error criterion, while the same penalization parameter is used in the second step. The estimates of A and B_j are then used to compute impulse responses in an obvious way.

Confidence bands for impulse responses are constructed using a residual-based moving block bootstrap as described by Brüggemann/Jentsch/Trenkler (2016), with a block length of 3 and 1000 iterations. In each draw, the residuals together with the exogenous instruments are re-sampled to construct simulated y_t, and impulse responses are estimated as described above, while the shrinkage parameter is re-estimated in each iteration. The simulated impulse responses are biased towards zero through the shrinkage approach, and we mitigate this effect by constructing standard 2/3 percentile intervals and adjusting the bounds by the difference between the estimated impulse responses and the median of the simulated impulse responses.

4 Results

We present impulse responses to structural RI and NRI shocks. Figure 3 shows that in the medium run an RI shock has adverse effects especially on the unemployment rate but also on per capita GDP and the wage share. This is likely to be explained by relatively low formal qualification, low transferability of human capital and a rather poor fit of refugees to the needs in the German labour market. It would represent a labour supply shock concentrated in segments with low wage flexibility and rather high unemployment risks (cf. Brücker et al. 2014).

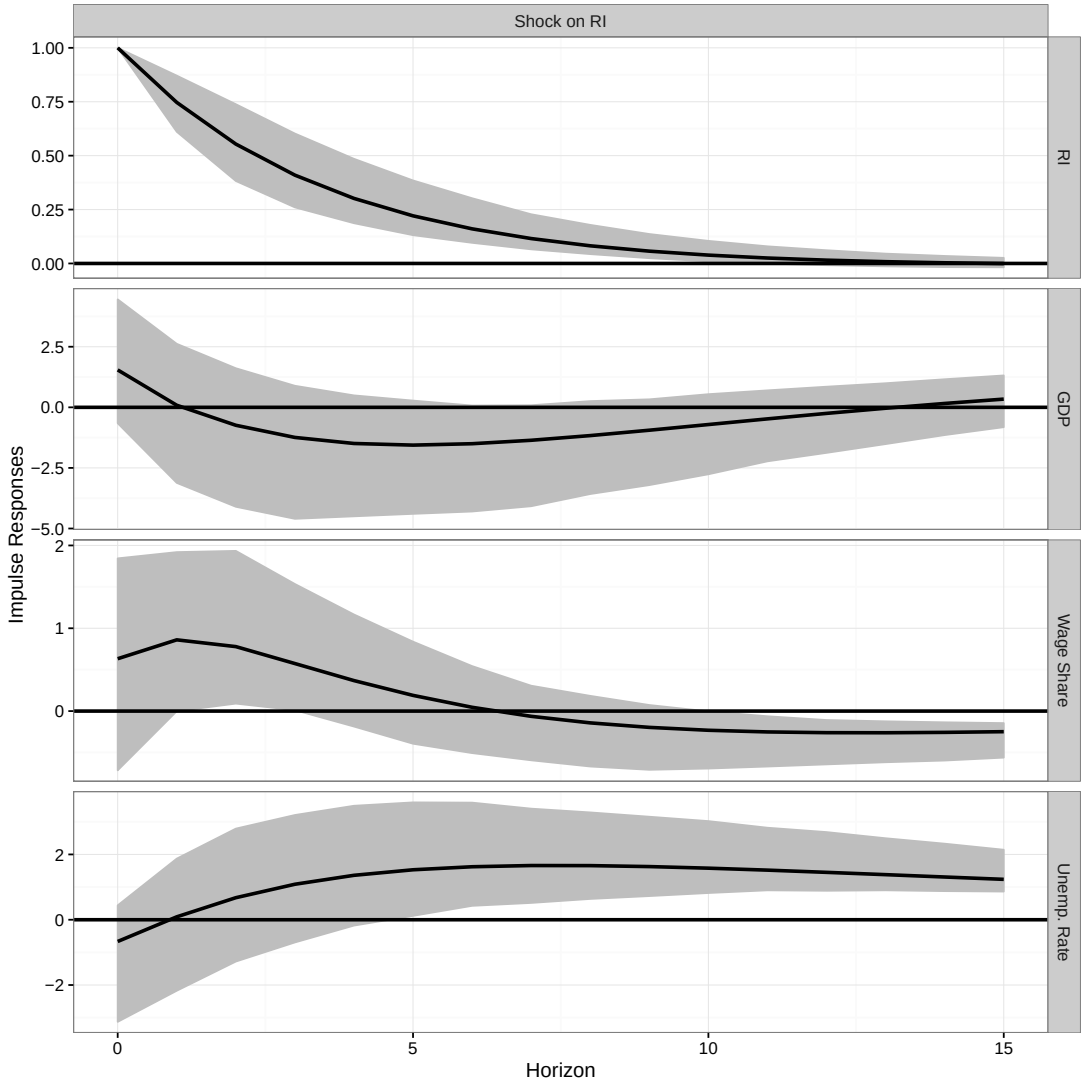
In the longer run, the adverse effects are reduced. This could be connected to further qualification and integration of the immigrants and adjustment of the capital stock that remains rather fixed in the short run – e.g. Ottaviano/Peri (2012). Still, the unemployment rate can remain increased since the composition of the work force changes. Thereby, for interpreting the relatively strong longer-run reaction of unemployment, the sizeable cumulated impulse response of RI must be taken into account – which amounts to 3.7 percent of the total population until horizon 15.

Short-run effects, even though relatively imprecisely measured, are more positive. These results are in line with demand-side effects in the macroeconomy. RI requires immediate investments, social assistance payments and hiring in fields such as administration, education or social work. These expenses usually go along with high multipliers. Additionally, asylum seekers become relevant for the labour market only with delay, also due to legal regulations, initially creating no pressure on wages and unemployment.

The impulse responses for shocks to NRI are depicted in Figure 4. Here, in contrast to the case of RI, the unemployment rate shows no clear reaction. By the same token, the wage share and per capita GDP remain rather constant. Notably, these low reactions of a per-capita value, a share and a rate imply that NRI increases the volume of the economy according to the average performance of the overall labour force.[4]

[4] If GDP is not taken per capita, its impulse response is significantly positive.

Figure 3: Responses to RI shocks.

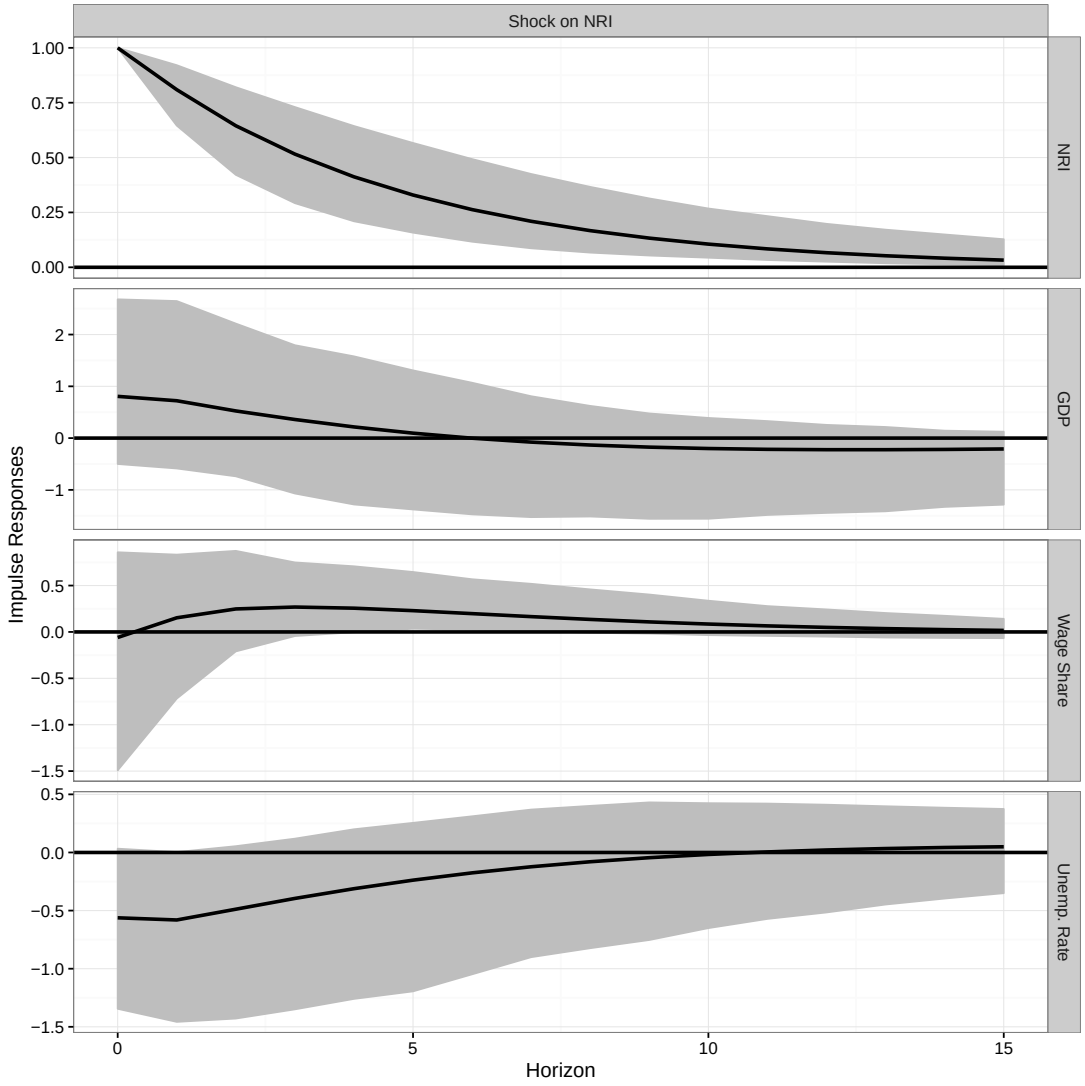


Source: Own calculations.
Notes: Migration flows measured in percent of total population, GDP effects in percentage changes of per capita real GDP, effects on the wage share and the unemployment rate in percentage points.

These results are likely due to the fact that NRI is in total more labour-market-oriented and higher skilled than RI. I.e., it is more likely that an immigration surplus and gains from complementarities can be realised. Moreover, domestic lower-skilled labour market segments could benefit from increasing labour supply in higher-skilled segments. In general, based on the separation of RI and NRI, our results favour the view that immigration (at least NRI) has no adverse effects on the German economy (e.g. Felbermayr/Geis/Kohler 2010).

Naturally, migration conditions and characteristics were not constant through the decades. However, the CUSUM test of Ploberger/Krämer (1992), based on structural residuals $\hat{\epsilon}_t$, found no evidence for structural breaks in the model parameters (available upon request). This strengthens our confidence that we can draw valid conclusions from our estimations.

Figure 4: Responses to NRI shocks.



Source: Own calculations.
Notes see Figure 3.

5 Conclusion

We analyse migration effects in a macroeconometric model setting, explicitly distinguishing RI and NRI. We find that in Germany, NRI has more beneficial medium-run effects. An RI shock first causes some positive (demand-side) reactions, but then lowers per capita GDP as well as the wage share and increases the unemployment rate. Nonetheless, these effects recede over time.

The implications for the current peak of RI to Germany are twofold. On the one hand, there are clear risks that economic conditions are adversely affected. However, on the other hand, the results for NRI show that immigration to Germany in general is not accompanied by negative effects. Therefore, if efforts regarding integration, language skills, qualification, use of informal competencies and labour market access succeed, economic results can be expected to improve visibly. Such a strategy requires significant initial investments.

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