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## The Macroeconomic Impact of Remittances: A Sending Country Perspective

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# The macroeconomic impact of remittances: A sending country perspective

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## Abstract

Remittances are for a large number of developing countries the most important source of foreign funding. Destination countries of migration, however, fear a outflow of financial funds. Using data for Germany, we analyze the impact of remittances and migration on one of the major sending countries of remittances and the third biggest exporter in the world. For this purpose, we develop a dynamic open-economy general equilibrium model with altruistic households. By estimating the interrelation between household characteristics and remittances, we are able to derive altruism coefficients for different types of households. Households with a higher altruism coefficient derive higher utility from consumption by distant relatives and send more remittances. We endogenize remittances flows by applying these coefficients to our model. Remittance outflows have then a depreciating effect on the real exchange rate and provide incentives to reallocate resources from the non-tradable goods to the tradable goods sectors. In the case of Germany, this translates into a opposite Dutch disease phenomenon.

*Keywords:* EU Eastern enlargement, remittances, international migration, computable equilibrium model

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## 1. Introduction

In the two decades after the fall of the Berlin Wall, open borders and EU accession of middle- and eastern-European countries<sup>1</sup> resulted in diminishing pecuniary and non-pecuniary costs of movement. Those diminishing costs strongly increased labor mobility in Europe, and thus, remittances. Alongside higher intra-EU migration, the number of asylum-seekers from extra-EU countries is growing. In the medium term, this will also boost remittances.

We know from Development Economics that remittances can have serious consequences for production in the receiving country. However, little is known about the effects of remittances on sending countries. In this paper, we focus on Germany, the country that sends the largest amount of remittances in Europe, and the fifth biggest sender in the world. In 2013, Germany's remittances outflows were worth 19.6 billion US-Dollar, equivalent to one third of its FDI outflows in the same year (World Bank, 2016). The continuing large influx of migrants to Germany - estimated as a net-increase of over 500,000 people per year<sup>2</sup>, is expected to further increase this figure. Additionally, in the year 2015 more than one million people were registered in initial reception facilities and 480.000 applied for asylum in Germany. Not all of those will be acknowledged as asylum-seekers and some will move to other countries, but net-migration and remittances are about to stay on record heights in upcoming years.

From an economic perspective, remittances affect the real exchange rate between migrants' home and host country and change the sectoral structure of production which might then trigger Dutch disease<sup>3</sup> like effects. To address this issue, we have built a dynamic open-economy general equilibrium model, with altruistic households sending remittances. We endogenize remittances flows by estimating the likelihood of households to remit, and the share of income that is remitted and by using these estimates to calculate coefficients that describe the altruism of different types of households at any given point in time. Our results indicate, that the exceptionally high inflow of migrants and the corresponding remittances flows, indeed, trigger a Dutch disease like effect that benefits the

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<sup>1</sup>The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia joined the EU on May 1st, 2004. Cyprus and Malta also joined the EU in 2004, but the transitional periods for the free movement of workers do not apply to these countries. Bulgaria and Romania joined the EU on January 1st, 2007.

<sup>2</sup>We used the latest available statistics on migration flows up to 2013 (Federal Statistical Office of Germany, Wanderungen, 23.02.2015) which also includes asylum-seekers. The most recent tremendous increase in asylum seekers, however, is not covered yet. In general, including refugees is tricky, as in the first years they have limited access to labor markets and, therefore, may not be able to send remittances. We cope with this problem by taking into account employment rates of migrants. In the near future, some restrictions might fall as the German government rethinks its asylum policy and the labor market status of asylum seekers.

<sup>3</sup>The Dutch disease phenomenon typically refers to a situation where a country exports natural resources and harms its export sector by appreciating the currency. In this article, migrants send remittances to their home country, which depreciates German currency and benefits its export sector. The phenomenon, where a country sends transfers to another country and benefits from depreciation, results in an opposite Dutch disease effect.

export sector in Germany.

Naturally, we are not the first to analyze the impact of remittances on the macroeconomy. Research on remittances and migration has grown sharply over the last few years.<sup>4</sup> Some studies use dynamic general equilibrium models to relate the business-cycle literature to migration and remittances. Mandelman (2013), Mandelman and Zlate (2012) and Acosta et al. (2009) introduce remittances, or migration and remittances, into a DSGE framework. These studies draw on the investment motive of remittances viewing remittances as a specific form of foreign savings heading towards developing countries. In contrast, the economic literature on trade sees remittances as an exogenous shock affecting the current account. In these studies, the occurrence of Dutch disease effects are analyzed (Lartey et al., 2012; Bourdet and Falck, 2006; Amuedo-Dorantes and Pozo, 2004) and labor supply effects of remittances are estimated (Fajnzylber and Lopez, 2008; Hanson, 2007; Funkhouser, 1995). Currently, a third strand of literature discusses the impact of remittances on growth. Remittances are perceived as a source of external funds that reduce poverty and boost growth (Adam et al., 2002; Bourguignon, 2006; Acosta et al., 2009). Remittances have a positive impact on financial development (Aggarwal et al., 2011) and help households to overcome financial constraints, which in turn increases spending on education (Acharya and Leon-Gonzalez, 2014). Both, a reduction in poverty and the easing of financial constraints can promote growth, explaining the positive impact of remittances on production as is seen in empirical studies (Dzansi, 2013). An increase in overall production does not necessarily mean that there is no impact of remittances on real exchange rates. Growth may have a positive but uneven impact on the sectors of the economy. All sectors grow but sectors producing non-tradable goods grow stronger than those producing tradables. A shift from tradable to non-tradable production then explains the Dutch disease effect found in many empirical studies (McCormick and Wahba, 2000; Amuedo-Dorantes and Pozo, 2004; Bourdet and Falck, 2006; Lopez-Cordova and Olmedo, 2007; Vargas-Silva, 2009; Acosta et al., 2009). Additionally, resource moving effects seem to be higher for countries with pegged exchange rates, as countries with a nominal peg cannot adjust international relative prices (Lartey, 2013). This may imply that the impact of remittances flows is stronger within a currency union like the Eurozone.

Most macroeconomic studies abstain from the reasons as to why migrants may remit, although the motive to remit can influence the properties of remittances flows. The incentives for a migrant to remit can be grouped into three separate categories, pure altruism, tempered altruism and pure self interest (Lucas and Stark, 1985). Within this framework, investment related remittances, either to maintain the line of inheritance (Stark and Lucas, Robert E. B., 1988; Hoddinott, 1994; La Briere, 2002), to buy specific assets available at home (Adam et al., 2002; Dustmann and Kirchkamp, 2002) or in preparation of returning to the home country (Johnson and Whitelaw, 1974; Lucas and Stark,

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<sup>4</sup>Clemens et al. (2015) provide an excellent overview on migration research.

1985), follow pure self interest. Repayments of investment in human capital, or support under the condition of coinsurance, (Stark and Lucas, Robert E. B., 1988; Sana and Massey, 2005; Amuedo-Dorantes and Pozo, 2006) are seen as tempered altruism. While caring for the expenses of family members in the home country is perceived as pure altruism. Empirical studies find evidence for all of the above mentioned motives of remittances while altruism plays the most crucial role (Stark, 1995; van Dalen et al., 2005; Rapoport and Docquier, 2006; Carling, 2008; Melkonyan and Grigorian, 2012; Shimada, 2012). In general, the motives to remit have different implications for the property of remittances flows. Arezki and Bruckner (2012) illustrates this fact by finding evidence that the correlation of remittances with rainfall, a measure of income in sub-Saharan Africa, is negatively correlated with remittances in countries with a high credit to GDP ratio, and positive in countries with a low credit to GDP ratio. This implies that in the latter case the investment motive of remittances dominates, while the insurance motive is more important in the former.

In this study, we introduce altruism to a macroeconomic model and combine the microeconomic strand of the remittances literature with the literature on the macroeconomic impact of migration (Brücker et al., 2014; Iranzo and Peri, 2009; Dustmann et al., 2008; Borjas, 1995). Although we focus on altruism, we use a Stone-Geary utility function that grants a subsistence level of consumption for migrants and household members that implies remittances flows that are in-line with the insurance motive of Arezki and Bruckner (2012). We also cover the investment motive by including cross-border asset purchases, but do not refer to these flows as remittances.

More specifically, remittances depend on the altruism of migrants in our model, it varies according to individual migrants' characteristics like gender, education and age. We estimate remittances as a function of these characteristics using the SOEP, a unique dataset on individual and household income and living conditions. Based on these estimates, we calibrate altruism coefficients for heterogeneous migrants planning to stay in Germany, either temporarily or permanently. We can show that crucial macroeconomic and labor market variables such as trade balance, private consumption, production, wages, and the unemployment rate are affected by an increase in remittances. Furthermore, our model explicitly considers the government and welfare sector, so that we are able to analyze the impact of migration and remittances, not only on production and trade, but also on taxes and the welfare system.

Accordingly, our paper contributes to the existing literature on migration and remittances in, at least, the following three ways. First, we explain the amount of remittances sent by migrants using a utility maximization framework that allows for altruism. Endogenous determined remittances have an influence on the nominal and real exchange rates that are affecting the sectoral distribution of production in the economy. Second, we estimate the remittance amounts sent by migrant households according to individual and partner characteristics. Thus, we rely on more recent periods and account for a broader migrant population than previous research. Third, we show that after an increase in migration, like it is observed for Germany, remittances can trigger

an opposite Dutch disease effect. To derive this result, we apply a dynamic general equilibrium model that is calibrated to the German national accounts, while altruism coefficients are derived using our own estimates. To our knowledge, a theoretical model combining endogenously determined remittances with a multi-sectoral general-equilibrium model is a novel approach in the economic literature on migration and remittances.

The remainder of this paper is organized as follows: Section 2 provides a theoretical outline of the general equilibrium model that is used in this study. The “estimation and numerical specification” sections (Sections 3 and 4) detail our empirical strategy and provide the calibration and simulation of the model. While the final section provides our conclusion.

## 2. The Model

In this section, we build a dynamic general equilibrium model that includes altruism and remittances. This theoretical model is the basis for our simulation exercise, which intends to capture the relationship between migration, remittances, the real exchange rate, and various sectors of the economy. These relationships are then used to explain the emergence of an opposite Dutch disease effect.

Remittances are endogenous in our model because of the utility optimization of altruistic households. There, we integrate the microeconomic altruistic model of Stark (1995) into a general equilibrium framework. Including altruism enables us to distinguish between different groups of migrants and to estimate altruism coefficients based on migrant characteristics and the expected duration of stay. The rationale behind the migration decision in our model is as follows. A household member decides to migrate with the agreement of his or her relatives back home. The potential remittance flows are considered in this decision. Accordingly, the utility of the migrant and relatives who live abroad are included in the migrant’s utility function. An “altruism” coefficient weights the amount of utility generated through consumption by relatives who stay in foreign countries and determines the amount of remittances to be transferred. These remittances flows affects the real exchange rate between the home and the host country of the migrant. We use a multi-sector framework to capture sector-specific effects and to account for the fact that there is a very small non-tradable sector in Germany. Furthermore, we can account for the complex relationships of international production chains and the demand for intermediate goods to achieve further insight into the appearance of Dutch disease like effects. Finally, we include imperfect labor markets and the state sector to allow for labor market effects of remittances and to derive the impact of migration and remittances on taxes and government spending.

### 2.1. Households

The model economy consists of a large number of households with infinite lifespans. We assume that the rational expectation hypothesis is best to describe

household behavior. Households own labor and all financial assets except those of public firms.

In each period, the household maximizes a utility function over an infinite horizon to find the optimum inter-temporal allocation of consumption.

$$\max_v V_t = \prod_{t=1}^{\infty} \frac{(1+g_t)^{t-1}}{(1+\rho)^t} U_t(\cdot)$$

The utility function is maximized subject to a budget constraint  $A_{t+1} = (1+R_t)A_t + (1-ty_t)Y_t - P_t C_t$ , with assets  $A_t$  rated at the beginning of period  $t$ , net household income  $(1-ty_t)Y_t$ , income taxes  $ty_t Y_t$ , interest rate  $R_t$ , time preference rate  $\rho$ , growth rate of households  $g_t$ <sup>5</sup>, consumption  $C_t$ , and price index  $P_t$  for aggregate household consumption. If we assume that the household is on a steady-state growth path from period  $T$  onwards, we can rewrite the utility function as

$$\max_{v_t} V_t = \prod_{t=1}^{T-1} \frac{(1+g_t)^{t-1}}{(1+\rho)^t} U_t(\cdot) + \left( \frac{1}{\rho - \bar{g}} \right) \left( \frac{1+\bar{g}}{1+\rho} \right)^{T-1} U_T(\cdot) \quad (1)$$

which, by setting up the Bellman equation<sup>6</sup>, using assets as control variable and applying the envelope theorem according to Benveniste-Scheinkman, implies the Euler equation

$$\frac{C_t}{C_{t-1}} = \frac{(1+R_t)(1+g_t)}{(1+\rho)} \frac{P_{t-1}}{P_t} \quad t = 1, \dots, T \quad (2)$$

and gives us the terminal condition

$$R_T = \rho. \quad (3)$$

Household income is defined as the sum of labor and capital income, transfers, and remittances less taxes and social security contributions.

$$(1-ty_t)Y_t = \sum_{t=1}^{\infty} \left( \sum_{a=1}^n (1-tk_{t,a})d_{t,H}D_{t,a} + \sum_{a=1}^n (1-tl_{t,a})W_{t,a}L_{t,a} \right) + \sum_{t=1}^{\infty} \left( b_t \cdot W_t \cdot \left( N_t - \sum_{a=1}^n L_{t,a} \right) \right) \quad (4)$$

<sup>5</sup>The growth rate of households depends on an exogenous growth rate and migration until period  $T$  and is constant thereafter.

<sup>6</sup>To ensure a convenient version of the envelope theorem, we use the Bellman equation  $V(A_t) = \max_{A_{t+1}} \left( \begin{array}{l} U_t \left( (A_{t+1} - (1+R_t)A_t - (1-ty_t)Y_t) \frac{1}{P_t} \right) \\ + \frac{(1+g_t)}{(1+\rho)} V \left( (A_{t+2} - (1+R_{t+1})A_{t+1} - (1-ty_{t+1})Y_{t+1}) \frac{1}{P_{t+1}} \right) \end{array} \right)$ .

The household receives dividends  $D_{t,a}$  for its ownership of firm assets and wages  $W_{t,a}$  for supplying labor  $L_{t,a}$ . Both sources of income are subject to specific capital  $tk_{t,a}$  or labor-related taxes  $tl_{t,a}$ . Because of imperfect labor markets, it is likely that labor supply  $N_t$  exceeds labor demand in various sectors of the economy. For the share of unused labor, the household receives unemployment benefits, which are a fraction  $b_t$  of average labor income  $W_t$ .

The remaining income is defined as household income  $Y_t$  net of income taxes  $ty_t Y_t$ . We further assume that some relatives of the household live abroad (e.g., in a distant source country). The utility of these relatives enters the utility function of the migrant household in the host country, whereas the migrant's utility enters the utility function of those household members remaining in the source country. The utility function  $u_t$  of the migrant household and the utility function of the relatives back home  $u_t^*$  take the following form:

$$U_t(C_t, C_t^*) = \beta_t U_t^*(C_t^*, C_t) + (1 - \beta) u_t(C_t), \quad (5)$$

$$U_t^*(C_t^*, C_t) = \beta_t^* U_t(C_t, C_t^*) + (1 - \beta^*) u_t^*(C_t). \quad (6)$$

A household derives utility  $U_t(C_t, C_t^*)$  through its own consumption of goods  $C_t$  and the utility of relatives abroad  $U_t^*(C_t^*, C_t)$ . The parameters  $\beta_t$  and  $\beta_t^*$  can be interpreted as exogenous altruism coefficients.

The utility function of household members who stay in a foreign country evolves analogously. The two equations (5) and (6) are solved for  $u_t(\cdot)$  with

$$U_t(C_t, C_t^*) = (1 - \tau_t) u_t(C_t) + \tau_t u_t^*(C_t^*). \quad (7)$$

Here,  $\tau_t = \frac{\beta_t(1-\beta_t^*)}{1-\beta_t^*\beta_t}$  and  $0 \leq \tau_t \leq \frac{1}{2}$ . The migrant's utility function is rewritten as an indirect utility function:

$$U_t(C_t, C_t^*) = (1 - \tau_t) u_t((1 - ty_t) Y_t - S_t - T_t), \quad (8)$$

$$+ \alpha \tau_t u_t^*((1 - ty_t^*) Y_t^* - S_t^* + T_t)$$

where savings are defined as  $S_t \equiv A_{t+1} - (1 + R_t) A_t$ .

We follow Rapoport and Docquier (2006) by maximizing the migrant's utility function for optimal remittances and assuming that relatives don't send remittances. This yields the first order condition:

$$-(1 - \tau_t) \frac{\partial u_t}{\partial C_t} + \tau_t \frac{\partial u_t^*}{\partial C_t^*} \leq 0. \quad (9)$$

Because the migrant and his or her relatives have similar preferences by assumption, optimal remittances can be expressed as a function of net-incomes.

$$T_t = \tau_t ((1 - ty_t) Y_t - S_t)_t - (1 - \tau_t) ((1 - ty_t^*) Y_t^* - S_t^*) \quad (10)$$



Consumers' preferences are specified using a Stone-Geary<sup>7</sup> function. This utility function has the property that households derive utility only from a fraction  $C_t = \prod_{c=1}^n (Q_{t,c} - \gamma_{t,c})^{\alpha_c}$  of total consumption. There exists a subsistence level  $\gamma_{t,c}$  that has to be reached before getting any utility. If consumption of either the migrant or the relatives back home is below this subsistence level, every additional unit of disposable income is spent to reach this ceiling.

In general, we can setup an intra-period sub-utility function that is maximized subject to disposable income and the budget constraint of the household. The share parameter  $\alpha_{t,c}$  denotes consumers' preferences in the supernumerary income and  $P_{t,c}$  denotes the price of commodity  $c$  of which the quantity  $Q_{t,c}$  is consumed.  $E_t$  are expenditures used for consumption and net of remittances.

$$\max_{Q_{t,c}, \gamma_{t,c}} u(Q_{t,c}, \gamma_{t,c}) = \prod_{c=1}^n (Q_{t,c} - \gamma_{t,c})^{\alpha_c} \quad (11)$$

s.t.

$$E_t \leq \sum_{c=1}^n (1 + tq_{t,c}) P_{t,c} Q_{t,c}$$

with  $Q_{t,c} > \gamma_{t,c} \geq 0$ ,  $E_t = (1 - ty_t) Y_t - S_t - T_t$  and  $\sum_{c=1}^n \alpha_c = 1$  for  $c = 1, 2, \dots, n$ .

We derive the tangency condition by differentiating the Lagrangian with respect to its arguments followed by equating the results to zero and then rearranging them. This process can be used to derive the demand relations for each good and to obtain the expenditures on each commodity. The parameter  $\alpha_c$  can be used as the marginal budget share.

$$(1 + tq_{t,c}) P_{t,c} Q_{t,c} = (1 + tq_{t,c}) P_{t,c} \gamma_{t,c} + \alpha_c \left( E_t - \sum_{c=1}^n (1 + tq_{t,c}) P_{t,c} \gamma_{t,c} \right) \quad (12)$$

The expenditure on each commodity can be divided into two parts. The first part is the minimum quantity required to obtain a minimum subsistence level of consumption. The second part depends on the available income that remains after buying the required quantities of each good. The budget constraint is only met if the sum of both shares of consumption equals one. The parameter  $tq_{t,c}$  denotes commodity-specific taxes. Deriving the income elasticity of commodity  $c_t$  is straightforward.

$$\xi_c(Q_{t,c}, E_t) = \frac{\partial Q_{t,c}}{\partial E_t} \cdot \frac{E_t}{Q_{t,c}} = \frac{\alpha_c E_t}{(1 + tq_{t,c}) P_{t,c} Q_{t,c}} \quad (13)$$

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<sup>7</sup>We use the Stone-Geary function as we want to simulate the model and the more simple Homothetic Cobb-Douglas (HCD) function over-predicts demand in some goods in Western-Europe by up to 77 per cent (Yu et al. 2004). We, however, do not use the more complex Implicitly Direct Additive Demand System (AIDADS) function, as the differences to the Stone-Geary function can be neglected for OECD countries (Yu et al. 2004).

Following Saito (2004), we derive a Frisch parameter  $\phi$  by solving the Lagrange function for the Lagrangian  $\lambda$  and calculating the expenditure elasticity of the marginal utility of expenditure. The result is the Frisch parameter.

$$\phi = \frac{d\lambda_t}{dE_t} \cdot \frac{E_t}{\lambda_t} = - \frac{E_t}{(I - \sum_{c=1}^n P_{t,c} \gamma_{t,c})} \quad (14)$$

In Section 4.1, we use the Frisch parameter to calibrate  $\gamma_{tc}$ , the minimum required quantity of a good consumed by the representative household.

## 2.2. Firms

Our economy consists of  $i$  sectors, where representative firms operate under perfect competition. Each firm has an infinite horizon and maximizes its value accordingly by defining an optimum strategy for the use of investment, employment, and intermediate goods. Similar to households, firm expectations are built according to the rational expectation hypothesis.

$$\sum_{t=1}^{\infty} \prod_{s=1}^t \left( \frac{1}{1 + R_s} \right) (D_{t,a} - \hat{V}_{t,a}) \quad (15)$$

where  $D_{t,a}$  are dividends,  $\hat{V}_{t,a}$  are new shares, and  $R_s$  is the steady-state interest rate. Maximization of firm value is subject to four constraints: the law of motion of capital, the terminal condition, a fixed base-year capital stock in the first period, and the definition of dividend payments.

$$K_{t+1,a} = (1 - \delta) K_{t,a} + QI_{t,a} \quad (16)$$

$$K_{T+1,a} = (1 + g)K_{T,a}$$

$$K_{T,a} = \bar{K}_{S,a}$$

The capital stock  $K_t$  depreciates with the rate  $\delta$  and increases through investment  $QI_{t,a}$ . It is assumed that the capital stock is in a steady state from time  $T$  onwards. Therefore, the capital stock in  $T + 1$  is the terminal capital stock  $K_{T,a}$  multiplied by growth rate  $g_T$ .

Dividend payments are defined as the difference between turnover, wages of employees, the costs for intermediate good usage, and retained profits used for investment.

$$D_{t,a} = P_{t,a}Q_{t,a} - W_{t,a}L_{t,a} - PN_tQN_{t,a} - adj_{t,a} - rp_tPI_tQI_{t,a}, \quad (17)$$

where  $P_{t,a}$  is the output price of commodity  $Q_{t,a}$ ,  $W_{t,a}$  is the sector-specific wage,  $PN_t$  is the price for intermediate goods,  $QN_{t,a}$  is the quantity of intermediate goods,  $rp_t$  are the retained profits,  $PI_t$  is the price of capital,  $adj_{t,a}$  are

the adjustment costs of capital and  $QI_{t,a}$  is the quantity of investment goods demanded through activity  $a$ .

Output  $Q_{t,a}$  is produced using a nested production function. In the upper nest, the firm combines gross value added  $QV_{t,a}$  and the aggregate intermediate goods  $QN_{t,a}$ . Depending on the production structure of the economy, gross output can be divided into different goods  $Q_{t,a}\phi_{c,a} = Q_{t,c}$ , where  $\phi_{c,a}$  is a share parameter.

$$Q_{t,a} = A(\mu_a QV_{t,a}^{-\rho_a} + (1 - \mu_a)QN_{t,a}^{-\rho_a})^{-\frac{1}{\rho_a}} \quad (18)$$

In the lower nest, value added  $QV_{t,a}$  is generated using capital  $K_{t,a}$  and labor  $L_{t,a}$  and various intermediate goods are combined to a aggregate intermediate good. The parameter  $\rho_a$  denotes the elasticity of substitution among the different factors,  $A$  denotes factor productivity, and  $\mu_a$  is the share parameter of production. The corresponding substitution elasticity for the lower nest is  $\rho\nu_a$ , the share parameter  $\mu\nu_a$  and factor productivity  $A_a$ .

$$QV_{t,a} = A_a (\mu\nu_a K_{t,a}^{-\rho\nu_a} + (1 - \mu\nu_a)L_{t,a}^{-\rho\nu_a})^{-\frac{1}{\rho\nu_a}} \quad (19)$$

As shown in equation (17), one source of financial means for investment is retained profits. A second source is new shares  $V_{t,a}$  issued by the firm.

$$\hat{V}_{t,a} = (1 - rp_t)PI_t QI_{t,a}. \quad (20)$$

where  $\hat{V}_{t,q}$  are new shares. Based on our perfect financial market assumptions, the expected return from holding equity in the firm must equal the return from holding a safe asset in any period.

$$R_t = \frac{D_{t,a}}{V_{t,a}} + \frac{V_{t+1,a}^0 - V_{t,a}}{V_{t,a}}.$$

$V_{t+1,a}^0$  is defined as the value in period  $t + 1$  of all existing market shares that are issued prior to period  $t$ . The total investment expenditures  $TI_{t,a}$  are,

$$TI_{t,a} = PK_t QI_{t,a} + adj_{t,a},$$

where  $PK_t$  is the price for the composite investment good  $QI_t$  described as CES composite with the elasticity of substitution  $\rho I$  and the share parameter  $\mu I_c$ . Furthermore, we assume quadratic adjustment costs  $adj_{t,a} = P_{t,a}\phi\frac{QI_{t,a}^2}{K_{t,a}}$ , where  $\phi$  is the adjustment cost parameter. The presence of adjustment costs implies that the firm has to bear costs in terms of production for installing new capital. Because adjustment costs are quadratic, the firm smooths the adjustment of the capital stock. We apply this assumption, as the labor market impact of immigration relies on the capital stocks speed of adjustment (Borjas, 2013).

$$QI_t = aI \left( \sum_{c=1}^n \mu I_c I_{t,c}^{-\rho I} \right)^{\frac{-1}{\rho I}} \quad (21)$$

Considering that the economy is in the steady state from  $T$  onwards, the firms maximization problem is

$$\begin{aligned} \max_{K_{t,a}, L_{t,a}} V_t &= \sum_{t=1}^{T-1} \prod_{s=1}^t \left( \frac{1}{1+R_s} \right) (D_{t,a} - \hat{V}_{t,a}) \\ &+ \frac{1+R_s}{R_s-g} (D_{T,a} - V_{T,a}) \prod_{s=1}^T \left( \frac{1}{1+R_s} \right). \end{aligned} \quad (22)$$

Maximizing firm value subject to the constraints provides the first-order conditions

$$\begin{aligned} P_{t,a} 2\phi \frac{QI_t}{K_{t,a}} + PK_t &= \lambda_{t+1,a} \\ \left[ P_{t,a} PV_{t,a} \delta_a (1-\delta_t) \left( \frac{Q_{t,a}}{QV_{t,a}} \right)^{(1+\rho_{a,t})} \frac{QV_{t,a}}{K_{t,a}} + P_{t,a} \phi \frac{QI_{t,a}^2}{K_{t,a}^2} \right] \\ &+ (1-\delta) \lambda_{t+1,a} - (1+R_t) \lambda_{T,a} = 0 \end{aligned}$$

$$K_{t+1,a} = (1-\delta) K_{t,a} + QI_{t,a}$$

$$L_{t,a} = (1-\mu v_a) \left( \frac{W_{t,a}}{PV_{t,a}} \right)^{\rho v_a} \mu_a \left( \frac{PV_{t,a}}{P_{t,a}} \right)^{\rho_a} Q_{t,a}$$

$$IN_{t,a} = (1-\mu_a) \left( \frac{PN_{t,a}}{P_{t,a}} \right)^{\rho_a} Q_{t,a}$$

where  $\lambda_t$  denotes the shadow price of capital,  $\delta$  is the depreciation rate,  $PV_{t,a}$  denotes the price of value added and the terminal conditions take the form

$$QI_{T,a} = (g + \delta_a) K_{T,a}$$

$$\lambda_{T,a} = PK_T + 2\phi P_{T,a} QI_{T,a} / K_{T,a}$$

$$\rho = R_T.$$

## 2.3. World economy

Import prices  $pm_{t,f,c}$  and export prices  $px_{t,f,c}$  are measured in local currency. Tariffs and non-tariff trade barriers on either imports  $tm_{t,f,c}$  (charged by the home country) or exports  $tx_{t,f,c}$  (charged by the foreign country group  $f$ ) respectively increase import prices and reduce export prices. The model accounts for country-specific exchange-rate regimes, where  $\epsilon_{t,f}$  denotes the exchange rate and  $pm_{t,f,c}$  and  $px_{t,f,c}$  respectively denote import and export prices in the foreign currency. We, furthermore, group countries to  $o$  different country groups  $f$ , namely intra-EMU countries and extra-EMU countries.

$$pm_{t,f,c} = (1 + tm_{t,f,c}) \epsilon_{t,f} pm_{t,f,c}^* \quad (23)$$

$$px_{t,f,c} = (1 - tx_{t,f,c}) \epsilon_{t,f} px_{t,f,c}^* \quad (24)$$

## 2.3.1. Export sector

The firm has a choice between selling a given amount of its product at home  $QD_{t,c}$  or on the export market  $X_{t,c}$ . Firms maximize their revenues  $\Pi D_{t,c}$  based on a CET transformation function considering the prices of goods for exports  $PX_{t,c}$  and domestic sales  $PD_{t,c}$ . The parameter  $\rho q_c$  indicates the elasticity of transformation, whereas  $\gamma q_c$  is the share parameter and  $AD_c$  is the technology parameter of the CET function. The parameter  $AW_{t,c}$  accounts for different levels of technology.

$$\max_{X_{t,c}, QD_{t,c}} \Pi D_{t,c}(X_{t,c}, QD_{t,c}) = PX_{t,c} X_{t,c} + PD_{t,c} QD_{t,c} \quad (25)$$

s.t.

$$Q_{t,c} = AD_c [\gamma q_c X_{t,c}^{-\rho q_c} + (1 - \gamma q_c) QD_{t,c}^{-\rho q_c}]^{\frac{-1}{\rho q_c}} \quad (26)$$

We can determine the destination of exports by maximizing the revenue function based on a sub-CET function. The firm receives revenues  $\Pi F_{t,f,c}$  from selling goods  $x_{t,f,c}$  to different countries recognizing the corresponding export prices  $px_{t,f,c}$ . The parameter  $\gamma f_c$  is a shift parameter, whereas  $\rho f_c$  accounts for the substitution elasticity of different destinations within the sub-CET function and  $AX_c$  is the technology parameter.

$$\max_{x_{t,f,c}} \Pi F_{t,f,c}(x_{t,f,c}) = \sum_{f=1}^o px_{t,f,c} x_{t,f,c} \quad (27)$$

s.t.

$$X_{t,c} = AX_c \left( \sum_{f=1}^o \gamma x_{f,c} x_{t,f,c}^{-\rho f_c} \right)^{\frac{-1}{\rho f_c}} \quad (28)$$

After setting up the Lagrangian and the re-parameterization of  $\rho q_c = (1/\sigma q_c) - 1$ , we can derive the optimum supply for the home market  $QD_{t,c}$  and the world

markets  $X_{t,c}$ .

$$QD_{t,c} = (1 - \gamma q_c)^{\sigma q_c} PD_{t,c}^{-\sigma q_c} \left[ \gamma q_{t,c}^{\sigma q_c} P X_{t,c}^{1-\sigma q_c} + (1 - \gamma q_c)^{\sigma q_c} PD_{t,c}^{1-\sigma q_c} \right]^{\frac{\sigma q_c}{1-\sigma q_c}} Q_{t,c}/AD_c \quad (29)$$

$$X_{t,c} = \gamma q_c^{\sigma q_c} P X_{t,c}^{-\sigma q_c} \left[ \gamma q_c^{\sigma q_c} P X_{t,c} + (1 - \gamma q_c)^{\sigma q_c} PD_{t,c}^{1-\sigma q_c} \right]^{\frac{\sigma q_c}{1-\sigma q_c}} Q_{t,c}/AD_c \quad (30)$$

The supply for export goods for different countries is given by:

$$x_{t,f,c} = \gamma x_{f,c}^{\sigma x_c} p x_{t,f,c}^{-\sigma x_c} \left( \sum_{f=1}^o \gamma x_{f,c}^{\sigma x_c} p_{t,f,c}^{1-\sigma x_c} \right)^{\frac{\sigma x_c}{1-\sigma x_c}} X_{t,c}/AX_c \quad (31)$$

### 2.3.2. Import sector

A wholesaler minimizes the costs of intermediate and final goods by combining different sources according to an Armington function  $\Gamma_{t,m,c}$ . The Armington function implies that goods are differentiated among countries; however, goods from different countries can be close substitutes. In the first nest of the Armington function, the wholesaler chooses between imported goods  $M_{t,c}$  with price  $PM_{t,c}$  and domestically produced goods  $QD_{t,c}$  with price  $PD_{t,c}$ . The parameter  $\gamma a_c$  is the shift parameter and  $AA_c$  the technology parameter of the Armington function, and  $\rho a_c$  is the elasticity of substitution of goods from different source countries.

$$\min_{M_{t,c}, QD_{t,c}} \Gamma D_{t,c}(M_{t,c}, QD_{t,c}) = PM_{t,c} M_{t,c} + PD_{t,c} QD_{t,c} \quad (32)$$

s.t.

$$Q_{t,c} = AA_c \left[ \gamma a_c M_{t,c}^{-\rho a_c} + (1 - \gamma a_c) QD_{t,c}^{-\rho a_c} \right]^{\frac{-1}{\rho a_c}} \quad (33)$$

In the second nest of the Armington function  $\Gamma F_{t,f,c}$ , the wholesaler minimizes its costs by choosing the optimum combination of different commodities  $m_{t,f,c}$  with respective prices  $pm_{t,f,c}$  from various countries. The parameter  $\gamma m_{f,c}$  is a shift parameter, and  $\rho m_{t,f,c}$  is the elasticity of substitution of import goods from different source countries. The parameter  $AM_{t,c}$  denotes the various levels of technology in different sectors.

$$\min_{m_{t,f,c}} \Gamma F_{t,f,c}(m_{t,f,c}) = \sum_{f=1}^o pm_{t,f,c} m_{t,f,c} \quad (34)$$

s.t.

$$M_{t,c} = AM_c \left( \sum_{f=1}^o \gamma m_{f,c} m_{t,f,c}^{-\rho m_c} \right)^{\frac{-1}{\rho m_c}} \quad (35)$$

Thus, we can derive the demand for imports and domestic production in the home market. We also use the identity  $\rho a_c = (1/\sigma a_c) - 1$ .

$$QD_{t,c} = (1 - \gamma a_c)^{\sigma a_c} PD_{t,c}^{-\sigma a_c} \left[ \gamma a_c^{\sigma a_c} PM_{t,c}^{1-\sigma a_c} + (1 - \gamma a_c)^{\sigma a_c} PD_{t,c}^{1-\sigma a_c} \right]^{\frac{\sigma a_c}{1-\sigma a_c}} Q_{t,c}/AA_c \quad (36)$$

$$M_{t,c} = \gamma a_c^{\sigma a_c} PM_{t,c}^{-\sigma a_c} \left[ \gamma a_c^{\sigma a_c} PM_{t,c}^{1-\sigma a_c} + (1 - \gamma a_c)^{\sigma a_c} PD_{t,c}^{1-\sigma a_c} \right]^{\frac{\sigma a_c}{1-\sigma a_c}} Q_{t,c}/AA_c \quad (37)$$

The demand for imported goods from different countries is given by the following equation:

$$m_{t,f,c} = \gamma m_{f,c}^{\sigma m_c} p m_{t,f,c}^{-\sigma m_c} \left( \sum_{f=1}^o \gamma m_{f,c}^{\sigma m_c} p_{t,f,c}^{1-\sigma m_c} \right)^{\frac{\sigma m_c}{1-\sigma m_c}} M_{t,c}/AM_c \quad (38)$$

#### 2.4. Government

The government levies taxes on labor<sup>8</sup> and capital usage, income, and consumption. Additionally, it collects tariffs and receives dividends from the share of public firms  $d_{t,G,a}$  in each sector  $a$ . Consequently, the government revenue function  $YG_t$  takes the following form:

$$\begin{aligned} YG_t = & \sum_{c=1}^n \left( tq_{t,c} Q_{t,c} P_{t,c} + \sum_{f=1}^o tm_{t,f,c} \epsilon_{t,f} p_{t,f,c} m_{t,f,c} \right) \quad (39) \\ & + \sum_{a=1}^n \sum_{j=1}^n (tk_t K_{t,a} R_{t,a} + tl_t L_{t,a,j} w_{t,a,j}) \\ & + \sum_{a=1}^n d_{t,G,a} D_{t,a} + \sum_{h=1}^z ty_{t,h} Y_{t,h} \end{aligned}$$

The government spends its income on consumption  $QG_{t,c}$ , government savings  $SG_t$ , sector-related subsidies to firms  $Z_{t,a}$  and households  $Z_{t,h}$ , as well as unemployment benefits.

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<sup>8</sup>We assign public social security services to the state sector. Therefore, social security contributions are treated as taxes and insurance payments are considered transfers.

$$YG_t = (W_t \cdot b_t) \left( N_t - \sum_{j=1}^n L_{t,j} \right) + \sum_{a=1}^n P_{t,a} Z_{t,a} + \sum_{h=1}^z P_t Z_{t,h} + \sum_{c=1}^n P_{t,c} QG_{t,c} + SG_t \quad (40)$$

With respect to consumption, the government maximizes a Stone–Geary utility function subject to a budget constraint, which is derived using the equations (39) and (40).

$$\max_{CG_{t,c}, \gamma G_{t,c}} UG_t = \prod_{c=1}^n (QG_{t,c} - \gamma G_{t,c})^{\alpha g_c} \quad (41)$$

We assume that the state sector is not subject to VAT payments. The government’s consumption is split into subsistence consumption  $\gamma G_{t,c}$ , which is required for the functioning of the state, and optional consumption  $\alpha g_{t,c} P_{t,c} QG_{t,c}$  for “utility.”

$$P_{t,c} QG_{t,c} = P_{t,c} \gamma G_{t,c} + \alpha g_{t,c} P_{t,c} QG_{t,c} \quad (42)$$

In addition to consumption and transfers, the state sector holds assets of firms producing public goods.

### 2.5. Equilibrium conditions

We complete the model using the respective equilibrium conditions for the factor, goods, and foreign markets. The goods markets are in equilibrium if domestic and foreign production equal demand of household, government, and intermediate goods.

$$P_{t,c} Q_{t,g} + (1 + tq_c) P_{t,c} Q_{t,c} + P_{t,c} (QN_{t,c} + QN_{t,g}) = PD_{t,c} QD_{t,c} + \sum_{f=1}^o (pm_{t,f,c} m_{t,f,c}) - \sum_{f=1}^o (px_{t,f,c} x_{t,f,c}) \quad (43)$$

The sum of the share of public and private firms in each sector should equal one. Labor markets are subject to a wage-setting curve  $\bar{h}_t$  and therefore are in disequilibrium. Firms take bargained wages as given and adjust their labor demand.

$$\sum_{INS=0}^q d_{t,INS,a} = 1 \quad (44)$$

$$W_t = \bar{h}_t \left( N_t - \sum_{a=1}^n \sum_{g=1}^n \sum_{j=1}^n (l_{t,a,j} + L_{t,g,j}) \right) \quad (45)$$

The foreign sector is in equilibrium if imports, exports, and foreign savings are equal in terms of payment balances.

$$\sum_{f=1}^o \sum_{c=1}^n pm_{t,f,c} m_{t,f,c} = \sum_{f=1}^o \sum_{c=1}^n px_{t,f,c} x_{t,f,c} + \sum_{f=1}^o S_{t,f} \quad (46)$$



### 3. Estimation

In this subsection we outline the estimation procedure for the altruism coefficients of migrants. We know the optimal amount of remittances derived from equation (10), which can be expressed in terms of income in the home country and abroad:  $T_t = \tau_t (1 - s_t) Y_t - (1 - \tau_t) (1 - s_t^*) Y_t^*$ . Furthermore, if we assume that the effect of the income of relatives in the home country on remittances is small (Akkoyunlu and Kholodilin, 2008), the altruism coefficient can be derived by regressing remittances on income. This is because the home country income effect will be negated by aggregating data on migrants over citizenship and time.

There are several factors reducing remittances over time that we do not cover with our theoretical model. First, remittances can have a set target, such as repayment of education costs (Lucas and Stark, 1985), which are covered after some period. Second, remittances are sent solely to cover explicit and implicit migration costs. Third, demographic processes such as the death of elderly parents, or the completion of the child(ren)'s education, may reduce remittances over time (Carling, 2008). In summary, overtime the strength of ties with the home country may weaken, reducing the amount of remittances sent. As our model allows for heterogeneous agents, we distinguish migrants by years since arrival and estimate the altruism coefficients for various cohorts to cover those aspects. In addition, we distinguish between migrants with temporary and permanent plans. As some migrants return home each year, we used the habitation statistic by the register of foreigners to calculate a cohort-specific hazard rate for migrants.

#### 3.1. Data

To address the remittance behaviors of migrants in Germany and the degree of altruism in various households, we use the 1996–2012 SOEP waves.<sup>9</sup> The SOEP is a representative and longitudinal survey of German private households conducted since 1984 (Wagner et al., 2007). The SOEP is a unique dataset because of its oversampling of migrants. From the start of the SOEP study, households with foreign-born heads exceeded the proportion of migrants in the German population. This feature of the SOEP allows for detailed investigations of migrants' behaviors and remittances to their family members. Data have been updated several times to allow for the inclusion of 'new' migrants. In the SOEP, household heads are interviewed, and every household member above the age of 16 completes his or her own questionnaire. Individuals who move out of an existing panel household are surveyed in their new households. Finally, people who enter an existing panel household are also included in the panel. As household members sometimes report the same amount remitted, to avoid duplication of cases, we selected only those persons who identified themselves as household heads. We control for the number of household members and for

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<sup>9</sup>In 2012 the questions regarding temporary migration plans were not asked in the SOEP panel, accordingly our estimations are based on data from 1996 to 2011.

the migrants' partner characteristics. We selected only foreign-born migrants into the sample to address migrants with ties abroad, as opposed to Germans with foreign nationalities. Thus, we included naturalized migrants and excluded persons with a foreign nationality who were born in Germany. Additionally, we use an unbalanced sample that includes individuals who entered the sample after 1996, and subjects who were absent from one or more waves. As immigrants are highly mobile and may perform circular migration, this setting will help to reduce selection bias. Altogether we conduct our estimations on a sample of 13,969 cases.

### 3.2. Empirical specification

The SOEP includes a number of variables that measure migrants' past residency as well as future migration plans. Since 1996, a question to inquire on migrants' intentions to "remain in Germany permanently" was introduced to the SOEP. Moreover, the SOEP measures whether migrants remit money, as well as the remittance amount. We assume that migrants remit money to their country of origin, as it is likely that the migrant's parents or other family members who receive the money are living in the migrant's country of origin. However, we cannot prove this assumption based on the SOEP data, as it asks whether the person receiving the money lives abroad and not whether that location is the migrant's country of origin. For our simulation exercise, uncertainty about the destination of remittances is not important as the exchange rate is a weighted average among trading partners. Each year the SOEP asks migrants to provide detailed information about financial support they provide to their relatives or other persons outside of their households. Several questions distinguish between payments to parents/parents-in-law, children/children-in-law, spouses (separated or divorced), other relatives, and unrelated persons. In a second step, the respondents are asked to specify whether the recipients of remittances live in Germany or in a foreign country. Our first measurement of remittances includes a dummy variable, which only accounts for the fact that remittances are sent, and includes various transfers to people living outside of Germany sent by the household members. The constructed dummy variable is allocated a value of one when remittances are sent abroad and zero otherwise. Our second measurement accounts for the exact amount remitted. We use the logarithm of the remitted amounts in Euro<sup>10</sup>. As already specified for the estimation of the remittances, we control for the household heads', years since migration and temporary or permanent migration plans. Additional control variables include years of education, gender, and marital and employment status, as all of these variables influence earnings and thus access to money (which can be remitted). Moreover, we control for the number of persons and number of children under the age of 16 living in the host country household. On the one hand more people or children within a household may reduce the financial means available for remittances, on the other hand, they may reduce the necessity to remit money

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<sup>10</sup>The dependent variable takes the following structure:  $\log(\text{remittances in } \text{€} + 1)$ .

as it could mean that all household members are living in Germany. Moreover, we included information on the post government household income. In addition to the migrant's characteristics, we included the characteristics of the migrant's partner, regardless of his or her migration background and nationality. This approach allows us to draw a more complete picture of the household. Specifically, we use information on the partner's years of education and employment status.

We estimate the effects of these characteristics on the probability of remitting and on the remitted amounts using OLS and GMM models.<sup>11</sup> The GMM models were transformed using a forward orthogonal transformation (Arellano and Carrasco, 2003). As demonstrated by Dustmann and Mestres (2010), conventional fixed-effect models and forward orthogonal fixed-effects regressions (Arellano and Carrasco, 2003) may be biased when investigating remittances. Our choice in selecting the GMM Models is further justified by the ability of the GMM models to account for the notion that current remittances may depend on past remittances, and that migration plans may not be entirely exogenous. Finally, GMM models can be applied in the absence of other more sophisticated instruments. We start our estimations using simple OLS regressions based on the following equations:

$$T_{it} = \beta_0 + \tau * D_{it} + \beta_1 * temp + \beta_2 * par + \beta_3 * X_{it} + u_{it}, \quad (47)$$

$$T_{it} = \beta_0 + \tau * D_{it} + \beta_1 * temp + \beta_2 * par + \beta_3 * X_{it} + \beta_4 * par * Z_{it} + u_{it}. \quad (48)$$

$T$  measures either the probability that person  $i$  remits money over time  $t$  or the amount remitted. The first specification of our model described in equation (47) takes household heads' and household characteristics into account. Whereas the second specification includes, in addition, the household heads partners' characteristics.

Variable  $D_{it}$  covers the duration of the stay (based on years since migration), and parameter  $\tau$  measures altruism. The second dummy variable 'temp' measures the effect of migrants' intentions to leave Germany (temporary migrant=1) on the probability to remit and the remittance amounts. The next

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<sup>11</sup>The study which most closely parallels the empirical component of our paper is Dustmann and Mestres (2010), where using the SOEP the overall amount of remittances sent by migrants is derived while accounting for individual characteristics of migrants. As a new aspect, they find that plans to return to a home country are related to large changes in remittances flows. This corresponds to a theoretical paper, where Dustmann (2000) shows that migrants with a temporary migration plan invest less in the specific human capital of the host country and tend to have higher costs of leisure, than migrants with a permanent migration plan. Implications on remittances flows are twofold. At least in the first years they have more money to send as they invest less in human capital which reduces spending and they work more hours and, therefore, have a higher income. This holds true even if altruism is identical between temporary and permanent migrants. They, however, might also have stronger ties with the home country affecting their decision to go back. If this holds true, altruism should be also higher for temporary migrants.

dummy variable, specified in our equation as 'par', indicates the presence of a partner in the host country household. Other individual characteristics, such as education or labor market status, are covered by parameter  $X$ .

In the second specification (see equation 48), we include additional partner characteristics. These variables are included as an interaction term with the partner variable. For single migrants the variable is zero and does not affect remittance behaviors. For migrants with partners, this variable indicates the influence of the partner on the probability of remitting and on the remitted amounts. Partner characteristics enter the equations using parameter  $Z$ . We expect, for example, that partners who are employed full time contribute to the household financial means and thus the assets available to remit. Using GMM Models we can additionally include the previous years' remittances  $T_{it-1}$  into the equations (47) and (48). Moreover, we use "internal" instruments and thus the lags of the temporary variable.

### 3.2.1. Descriptive evidence

Table 1 provides descriptive information on migrants' remittance behavior for different household types, indicating migrants' annual post government household income, the annual amount remitted, the percentage of migrant households who remit, and the percentage of migrants' annual incomes that are spent on remittances. The last variable is calculated using the households' annual income and the annual amount remitted. The table shows that there are significant differences with regard to individual characteristics. On average, migrant households send €590 per year and 17 percent of households remit money.

Remittances are dependent on the migrant households' financial situation. Households where the household head is employed full-time send on average € 469.8 more abroad, than migrants who are part-time employed, who are working on marginal or irregular basis, or are unemployed. Overall, 21.5 percent of migrants who had full-time jobs send money to their home country, whereas only 15.6 percent of migrants from the other group do so. Additionally, we observe differences between households with male and female household heads. Households with a female household head remit not only less often and on average lower amounts, but they send also a lower percentage of their annual household income abroad.

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Table 1 on page 36 about here

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Differences in amounts remitted are the greatest among temporary and permanent migrants; they even exceed the differences we find between employed and unemployed household heads. Households where the household head has a temporary migration plan sent on average € 1,108 per year abroad, or 3.3 percent of their annual household income. This exceeds the amount households with a permanent migration plan remit by €710 (€ 398 or only 1.3 percent of their income).

### 3.2.2. Estimation results

Table 2 shows whether the differences found at the descriptive level can be confirmed using OLS and GMM models. The specifications of the estimations displayed differ with regard to the inclusion of migrants' partners characteristics. Model 2 estimations account for partners' employment and education and indicate the influence of partners' characteristics on the household decision. We report households' probability to remit and thus if transfers take place. The estimates of households' probability to remit are derived using linear models, as the estimation obtained with marginal effects from probit models are largely similar. Table 3 analyses the amounts remitted.

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Table 2 on page 37 about here

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In all of our models, the household heads' plans to temporarily stay in Germany shows a strong and positive effect on the probability of remitting and on the remitted amounts. The effects estimated with GMM models range in between the lower bond estimations obtained with fixed effects models and the higher bond estimations based on OLS models, as suggested by Roodman (2009).<sup>12</sup>

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Table 3 on page 38 about here

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All estimated models indicate that time spent in the host country negatively influences the probability of remitting and the remitted amounts. As already stated, over time the relationship with the host country weakens, thus reducing the probability and amount of remittances sent. At the same time, the GMM models indicate a path dependency: migrants who send money one year have a higher probability of also sending money the following year. The same is true for the amount remitted. Migrants who send high amounts of money one year, are also likely to send high amounts the following year. The impact of the age at migration is less clear as the effects are partly insignificant. Surprisingly neither the household heads' education, nor their gender, show a significant influence on the remittance behavior. In turn, households' head employment and household income, play an important role in the probability of sending money abroad and the amount remitted, as was indicated by Stark. When the household

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<sup>12</sup>To estimate the lower and higher bonds we used fixed effects and OLS regressions, where the lag of the dependent variable was included. Estimating the GMM models we instrumented the temporary migration plans using indicators for the past migration plans of the household heads' partner, which provided very similar results (available upon request). However, as using partners' migration plans restricts the sample to persons who are living in Germany with their migrant partners, we rely on the lag of the household heads' migration plans as to not restrict the sample to only those persons in partnerships.

head is employed full-time, the probability to remit is 4.5 percent higher and the amount remitted is 39.8 percent higher (Model 1 GMM).<sup>13</sup> Moreover, an increase in earnings by 1 percent increases the probability of remitting by 0.07 percent. With every percent that the household income increases, remittances increase by 0.3 percent (see GMM specification Model 1).

The inclusion of the variables that relate to the migrants' partners in the second Model specification indicates that the partner's employment status positively influences the probability to remit, but not the remitted amounts (see GMM specification Model 2). The education level of a migrant's partner does not seem to play an important role on remittances.

#### 4. Simulation

In this section we discuss the calibration of the model, describe the three scenarios, and present the simulation results. The model calibration relies on use and supply matrices that represent the interdependence between different branches and commodities within the economy. After the calibration process, the model can replicate the steady-state make-and-use matrix using the calibrated parameters. This enables us to conduct our simulation exercise. In the last subsection, by presenting the results of our simulations, we show that remittances have an impact on trade and GDP.

The dynamic general equilibrium model is solved simultaneously using the Path solver based on the Newson–Raphson method. Therefore, the general equilibrium problem was specified as a mixed-complementarity problem that Cottle et al. (2009) and Rutherford (1995) state can be best solved using this type of solver.<sup>14</sup> In the MCP approach, equilibrium conditions are formulated as weak inequalities and conditions of complementary slackness between variables and equilibrium conditions. The model is set up as an Arrow–Debreu economy with  $n = 21$  commodities and  $m = 21$  activities, classified according to CPC Ver. 2, and NACE 2, respectively.

##### 4.1. Calibration

In this subsection we describe the calibration of the model in more detail. Owing to the setup of our theoretical model, we can calibrate most parameters using make-and-use matrices (I–O matrices) based on the national accounts. For some categories such as transfers from the government sector to households or compensation of employees, additional information is required. In these cases we use labor market accounts, which are a part of the national accounts but are not reported in the I–O matrices. As we use the same base year, this data is consistent with the information from regular I–O matrices.

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<sup>13</sup>In our model, we use a Stone–Geary utility function to reflect these empirical findings.

<sup>14</sup>The Path solver is based on the Newson–Raphson method. According to the general algebraic modeling system (GAMS), the Path solver combines a number of the most effective variations, extensions, and enhancements to increase the efficiency of finding new approximations with this solution method.

We deviate from the above mentioned approach only in the case of base-year remittances. As remittances are included in the foreign savings category, we could use information from the balance of payments (BoP) statistics. The category 'workers' remittances' in the balance of payments is broadly in line with our concept of remittances, however only transfers through the banking system are covered, and only those exceeding a threshold of € 12,500. To avoid underreporting, we rely on the World Bank (2016) estimates of remittances.

#### 4.1.1. Households

In the household sector, we calibrate the Stone-Geary parameter for subsistence consumption and the shift and share parameters of the sub-utility function. The Stone-Geary parameter is calibrated using the Frisch parameter (equation 14)

$$\gamma_{c,h} = \frac{\sum_{c=1}^n (P_{s,c} Q_{s,c})}{P_{s,c} \bar{\alpha}_c (1 + \xi_c / \phi)},$$

where  $\xi_c$  are the cross-price elasticities,  $\bar{\alpha}_c$  are the budget shares, and  $\alpha_c = \bar{\alpha}_c \xi_c$  are marginal budget shares.

#### 4.1.2. Firms

In the firm section, parameters of the nested production function, adjustment costs, and the depreciation rate are calibrated. In the lower nest of the production function, capital and labor is combined into value added. We calibrate shift and share parameters. The shift parameters are calibrated using the first-order condition of equation (15)  $\mu_{s,a} = \left( \frac{P_{s,a}}{PV_{s,a}} \right)^{\rho_a} \left( \frac{QV_{s,a}}{Q_{s,a}} \right)$ ,  $\mu v_{s,a} = 1 - \left( \frac{PV_{s,a}}{W_{s,a}} \right)^{\rho_{v_a}} \left( \frac{L_{s,a}}{QV_{s,a}} \right)$ . Using equation (21), we derive  $\mu I_{s,a}$  in a similar fashion for the demand of single investment goods. Alternatively, the share parameter is calibrated using the value-added production function (equation 19):  $AV_{s,a} = QV_{s,a} / (\mu v_{s,a} K_{s,a}^{-\rho_{v_a}} + (1 - \mu v_{s,a}) L_{s,a}^{-\rho_{v_a}})^{-1/\rho_{v_a}}$ . Similarly,  $A_s, AI_s$  are set as the share parameters of the production function (which combines intermediate goods and value added (equation 18) and the production of the composite investment good (equation 21). However, the elasticities of substitution  $\rho_a, \rho_{v_a}, \rho_{l_j}, \rho_{k_j}, \rho_{I_a}$  cannot be calibrated and are set according to the empirical literature (Koesler and Schymura, 2012).

#### 4.1.3. Foreign sector

The exchange rate can be initialized in  $t = 0$  as unity  $\epsilon_{s,r} = 1$ , as data on imports, exports, and transaction costs are available in the domestic currency. Transaction costs are calibrated in the form

$$tx_{f,c} = sx_{s,c} \left( \sum_{cx=1}^{mx} cx_{s,c} / pq(cx)_{s,c} \right) / qx_{s,c},$$

where  $sx_{s,c}$  are the shares of commodity  $c$  in transaction services for export goods. Transaction coefficients for imports  $tm_{f,c}$  and domestic sales  $td_{f,c}$  are

derived analogously. The share parameter of the sub-CET function is calibrated using the first-order condition (26) solved for

$$\gamma q_{f,c} = p x_{s,f,c} x_{t,f,c}^{1+\rho f_c} / \left( \sum_{f=1}^o p x_{s,f,c} x_{t,f,c}^{1+\rho f_c} \right),$$

whereas the shift parameter is derived by solving equation (26) for

$$a x_c = X_{t,c} / \left( \sum_{f=1}^o p x_{s,f,c} x_{t,f,c}^{-\rho f_c} \right)^{\frac{1}{1-\rho f_c}}.$$

Similar share and shift parameters for the Armington, sub-Armington, and CET function are derived analogously. Tariffs are included in the transaction cost parameter as a type of government transaction good. The parameter  $\rho f_c$  and similar parameters for the Armington, sub-Armington, and CET function, however, cannot be calibrated. There are a variety of studies estimating Armington and CET preference parameters using different degrees of disaggregation and country coverage. We use the estimates of Saito (2004) but make several sensitivity tests with other estimates. In general, these alternative parameter settings only slightly alter the results.

#### 4.1.4. Government

The tax rates are calibrated as iceberg costs using information from the make-and-use matrices. Value-added tax is calculated as  $tq_{s,c} = T_{s,c} / (P_{s,c} Q_{s,c})$ , where  $T_{s,c}$  is the sum of tax receipts divided by the quantity sold of the taxed product. All other taxes  $ta_{s,a}, tf_{s,a}, tk_{s,a}$  are calibrated in a similar manner.

#### 4.2. Scenarios

Migration has been the key driving force for population growth in Germany since a drop in the birth-rate at the end of the 1960s and the beginning of the 1970s. The migration balance has been positive for most years, at between 129,000 and 354,000 people annually. However, in the 2000s net migration declined and the net migration rate was negative across some years. There are at least two reasons for this effect: The net outflow of people with a German citizenship increased; and the number of ethnic German immigrants from former socialist countries decreased. It was only after the opening-up of labor markets that net migration started catching up to pre-2000 levels. Favorable economic conditions, open labor markets, and an increasing demand in skilled workers, increased immigration. In addition, the aging population in Germany reduces the size of the cohort of people most likely to leave the country. With these considerations, the Federal Statistical Office in Germany is expecting migration to stabilize in the next decade at approximately 200,000 migrants<sup>15</sup>, after a short

<sup>15</sup>The Federal Statistical Office (DeSTATIS) offers a variety of different scenarios. We rely on Model 2, where migration is 200,000 migrants higher than in the low migration scenario of



period of extraordinary high net-migration inflows following the expiration of transitional periods that restricted labor market access for EU-2 migrants up to 2014, and for EU-8 migrants up to 2011. These estimates, however, are uncertain as the number of asylum-seekers increases strongly. In 2015, a year not covered in the migration statistics yet, the applications of asylum seekers increase to roughly 500.000. Even if the number of asylum-seekers finally staying in Germany will be much lower, it is getting more likely that the Federal Statistical Office is underestimating migration flows.

In Table 4 we present migration flows from 2000 to 2013 and a forecast based on the German statistical office's high-scale immigration scenario for the years from 2014 to 2023. In the projection, we see a strong deviation of migration from the long-term average, gradually declining, while not returning to the average until 2021. We use this deviation from the long-term average as the migration shock affecting our model economy. From 2014 to 2023, nearly 1.6 million additional migrants are expected to arrive in Germany, resulting in an approximated 2 percent increase in the labor force. As remittances of migrants depend on the duration of stay, inflows and outflows play a crucial role in determining overall remittance flows. Using our empirical estimates, we calculated the optimum amount of remittances households send back to their home country. By introducing heterogeneous migrants, we explicitly consider that altruism declines with the duration of stay.<sup>16</sup>

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Table 4 on page 39 about here

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Across all the scenarios of our model, remittances flows depend on the altruism coefficient determining individual remittances and the size of migration inflows. While the size of migration flows is equal across the scenarios, altruism coefficients differ. In the first scenario, we assume that migrants behave like natives. We know that natives also send remittances abroad as some may have a spouse or child(ren) in a foreign country, but these flows are much weaker than that of migrants. In this scenario, the migration shock increases remittances by 32 million in 2014, rising with migration to 224 million in 2023 are sent. In the second scenario, we assume that the share of migrants with a temporary migration plan stays constant over time. In this scenario, altruism coefficients and remittances are way higher. Migrants send remittances worth 623 million in 2014 and 5 billion in 2023 back to their home country. In the third scenario, we assume that all migrants arriving since 2014 have a temporary migration plan. Altruism is highest in this case, and remittances worth 871 million in 2014, and 6.5 billion in 2023. Finally, we calculate the labor market impact of

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Model 1.

<sup>16</sup>We used the German register of foreigners to calculate the composition of migrants with regard to duration of stay. For this purpose, we made the assumption that the decision on the length of stay is time independent.

migration. Following the migration projections, we assume that from 2014 to 2023 the population will increase by 1.6 million people across all scenarios. Incoming migrants are presumed to be young, and are therefore expected to have a high labor market participation rate of 74 percent, which in-turn will increase the labor supply in Germany by up to 2 percent at the end of our simulation period.

#### *4.3. Simulation results*

In this section, we use our model to calculate the effects of migration and remittances on the German economy according to the projection of the Federal Statistical Office for the period 2014 to 2023. We derive our results by comparing each policy scenario to a baseline, where we assume that migration stays constant at the long-term average of 200,000 migrants per year. The results are presented as percentage changes from the baseline, with the exception of the unemployment rate, which is presented as deviation from the baseline in percentage points. The size of the migration shock is common in all policy scenarios and can be found in Table 4. The policy scenarios differ with regard to the assumptions on the altruism of migrants. The impact of migration and remittances is based on the second policy scenario. The remittances effect is decomposed by computing the difference between the second policy scenario and the first policy scenario, where migrants, with regard to remittances, behave like natives. The impact of temporary remittances can be derived in a similar way by computing the difference between the third policy scenario, where migrants are all assumed to behave like temporary migrants and the first policy scenario, where migrants act like natives. Results indicated as temporary remittances can be seen as an upper bound for remittances, as the share of temporary migrants is expected to increase. At present, the duration of stay for people from EU-8 and EU-2 countries is far lower than that of migrants from non-EU countries. As labor markets open, we expect the share of those migrants to rise among overall migration numbers and that then migrants tend to stay for shorter periods of time.

In 2014, migration is expected to increase labor supply by 0.3 percent above the long-term average of 200,000 migrants a year. The additional migration declines thereafter until 2022 where migration returns to the long-term average again. In sum, from 2014 to 2023 the stock of migrants increases by 1.6 million people, compared to the baseline scenario. Relative to this baseline, the aggregate increase in GDP is 0.2 percent in 2014 and 1.5 percent in 2023. The increase in GDP is smaller than the increase in the labor force, as we presume that migrants increase the labor supply, but do not increase the capital stock of the host economy (see Figure 1).

Migration, therefore, reduces the capital stock per capita and increases the yield on investment. A higher yield increases the incentive for natives to save more. The same holds true for investors from abroad that increase foreign savings. Investment significantly rises from 0.9 percent in 2014, to 4.7 percent in 2021, and declines thereafter. Increasing savings, similar to remittances, have a depressing effect on overall income available for consumption. This factor

helps to explain the decrease in consumption in the migration and remittances scenario by 0.1 percent in 2014, and the slight increase of only 0.4 percent in 2023. Remittances, solely, depress private consumption cumulating to 0.3 percent in 2023. Tax revenues, because of an increase in the labor force and income tax, increase by 0.3 percent in 2014 and 1.9 percent in 2023. However, government consumption declines by 0.22 in 2014 and 0.7 percent in 2023, due to a decrease in compensation payments to the pay-as-you-go pension system. With an increase in labor supply, the ratio of contributors and beneficiaries in the pension system improves. Thus, less compensatory payments by the government are required, and government spending declines.

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Figure 1 on page 43 about here

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Remittances have a positive impact on GDP in our model. This phenomenon can be explained by an opposite Dutch disease effect benefiting the export sectors of the economy. In 2014, GDP increases by 0.01 percent and in 2023 by 0.11 percent, that amounts to 7.4 percent of the overall GDP effect of migration and remittances combined.

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Figure 2 on page 44 about here

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We can confirm a Dutch-disease-like effect by looking at the impact of migration and remittances on trade and the deviation of production among the sectors of the economy. In 2023, migration and remittances increase imports by 2.4 percent and raise exports by 2.8 percent. If we look at the effect of remittances only, exports increase by 0.7 percent, while imports increase by 0.6 percent. As most migrants arrive from Poland and Romania, real exchange rates between Germany and extra-Eurozone countries are primarily affected. As expected, imports decline and exports increase. In 2023, due to remittances, imports from the Rest of the World decrease by 1.2 percent while exports increase by 0.5 percent. For Eurozone countries, imports increase by 1.85 and exports by 0.81 percent, only. The impact on the Eurozone is bigger as it is not subject to exchange rate adjustments. In sum, the Eurozone heavily gains in trading shares (see Figure 2). The size of the trade effects relies on the assumption of the motive of remittances. If remittances substitute foreign savings, real exchange rate adjustment and trade effects are smaller. In our model, remittances are a result of altruism and are therefore not subject to an investment decision. Thus, they are determined independently from the decision on the share of savings that is channeled to foreign countries.

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Figure 3 on page 45 about here

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Figure 3 shows that remittances increases production strongly in the manufacturing and construction sector (C, F) and further, moderately across some sectors that provide education and health related services (M, N) that are disproportionately high in demand by migrants. Migration and remittances have a positive impact on mosts sectors, but particularly on trade related and investment related sectors. Activities that are strongly related to private consumption, and that have a small share among Stone-Geary subsistence consumption (I, R, S, T), tend to reduce production if remittances increase. However, migration has a positive effect on those sectors. Public services are affected in a similar manner to that of other services, but to a much smaller magnitude. Education, health, social services, and administration (P, Q) increase production with an increase in migration and reduce production with an increase in remittances. The size of the remittance effect, nevertheless, is small compared to the migration effect. Other resources required for manufacturing, such as water supply (E) and transportation (H) and energy (D), can similarly increase production but to a smaller magnitude than that of the manufacturing sector. Finally, construction (F) is closely related to investments: As investment increases and improves the capital stock after immigration, the construction sector can greatly increase production.

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Figure 4 on page 46 about here

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Most studies on migration report declining wages and a moderately increasing unemployment rate. Our model derives similar results due to the assumption of imperfect labor markets: An increase in labor supply lowers wages and increases unemployment (see Figure 4). Given the size of the migration shock, wages decline moderately by 0.15 percent in 2014 and 1.14 percent in 2023, whereas the unemployment rate increases by 0.18 percentage points in 2014 and 0.51 percentage points in 2023. Remittances increase both wages and the unemployment rate. This effect can be explained by an increase in demand for tradables that is transferred into a higher demand for labor. In contrast, in the service sectors of the economy we see a declining demand for labor in-line with a decline in production. As wages in the tradable sector are higher than those in the non-tradable sector, a decline in employment and an increase in unemployment can be accompanied by higher wages. This result essentially relies on the assumption that it is costly for a worker to switch from one sector of the economy to another. Wage differentials, therefore, can persist for a significant period of time. In sum, migrants supply additional labor, depress wages and increase unemployment. The effect on unemployment is stronger if we include remittances. Migrants, however, impose a less depressing effect on average wages in this scenario.

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Figure 5 on page 47 about here

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The effect of temporary migration is shown in Figure 5. If migrants plan to stay in Germany for only a short period of time, our empirical estimates show that they are more likely to remit, and to also send a higher amount of money. In terms of the altruism coefficient calibrated using these estimates, temporary migrants are more altruistic - as they reduce private consumption, they are able to remit more. In principle, remittances of temporary migrants should have a similar macroeconomic effect to those sent by permanent migrants. The only difference between the types of migrants should emerge from the scale of remittances; thus, we see a nearly proportional increase in the effect of remittances. As we have calculated the share of subsistence consumption using the Frisch parameter, if available income shrinks because of higher remittances, the share of subsistence consumption increases in terms of overall consumption, and the drop in consumption gets smaller if remittances increase. Additionally, because of differences in the importance of specific goods for subsistence consumption, the breakdown of demand for the different sectors of the economy should be different from a scenario where migrants send less remittances. In terms of our simulation results, this effect is small.

#### *4.4. Sensitivity Analysis*

The results of CGE models can be sensitive to behavioral parameters or elasticities specifying the sensitivity of economic agents to changes in relative prices. In general, the CGE literature discusses three different sets of elasticities, Armington elasticities, income elasticities and elasticities of substitution, that cannot be calibrated and have to be either estimated or taken from the econometric literature. Armington elasticities have been seen as the key parameter in international economics for a long time (Feenstra et al., 2014). They, therefore, have attracted most attention in the empirical literature and are subject to a vivid discussion about the optimum estimation strategy. Most studies estimate Armington elasticities for a specific country (Donnelly et al., 2004; Feenstra et al., 2014; Ivanova Nadezhda, 2005), mostly for the US, some use cross-section (Bilgic et al., 2002; Hummels, 1999) or panel methods (Saito, 2004; Feenstra et al., 2014). In general, cross-section and pool cross-section time series datasets make high estimated Armington elasticities more likely (Cassoni and Flores, 2008). High estimated elasticities are preferred to low estimated ones either because of methodological and empirical issues (Saito, 2004; McKittrick, 1998; Shiells et al., 1986) or theoretical reasons stating that low elasticities may arise because of ignoring supply side behavior (Cassoni and Flores, 2008). Time series estimates, additionally, focus solely on transitory rather than permanent shocks (Ruhl, 2008). This makes it difficult to use these elasticities for reliable simulations with CGE models (Riedel, 1988; Athukorala and Riedel, 1994). Beside the frequency and the econometric methodology used, the aggregation of products is a crucial issue in using estimated elasticities for CGE models. Pesaran (2003) and McDaniel and Balistreri (2003) arrive at the conclusion that elasticities from a disaggregated setup are more likely to be higher than that from an aggregate setting. Furthermore, many studies do not consider the specific nested CES

function frequently used in CGE models. Saito (2004) points out that the elasticity between home and foreign goods is generally lower than that of foreign goods from different locations. Feenstra et al. (2014) can confirm this finding for roughly half of the goods considered. Additionally, Welsch (2008) and Saito (2004) show that elasticities differ across countries.

The standard simulation run of our model uses the Armington elasticities of the GTAP project described in Hertel et al. (2012). These estimates best fit the division of goods within the model even that the manufacturing and the agricultural sector are more disaggregated in the GTAP project database and some service sectors are higher aggregated. For the sensitivity simulation run, we use the estimates of Saito (2004), Donnelly et al. (2004) and Welsch (2008). These studies, however, do either not estimate elasticities for service sectors or use a higher disaggregation of goods. The estimates from Donnelly et al. (2004) match the estimates of the GTAP model for service goods, where by the estimates for agricultural, manufacturing as well as mining and quarrying products are higher. Saito (2004) estimates elasticities explicitly for Germany and finds higher estimates for agricultural goods and lower ones for mining and quarrying and manufacturing goods. The results of Welsch (2008) are significantly lower and consider a time trend in the estimation model.

For the elasticity of substitution between capital and labor in the standard simulation run, we apply the estimates of Koesler and Schymura (2012) for Germany which exactly meet the classification of sectors used in our model. For the sensitivity run, we used the estimates of Okagawa and Ban (2008) that are significantly lower. We also use the estimates of Hertel et al. (2012) that were slightly higher than that of Koesler and Schymura (2012) but the impact on the results of the model are minor.

The expenditure elasticities of demand for Germany are taken from Hertel et al. (2012). For the sensitivity analysis we use the elasticities derived by Reimer and Hertel (2003) that use the same estimation strategy but an older dataset. Both studies estimate a more general function than the Stone-Geary function that is used in the model. Expenditure elasticities of the AIDADS, nevertheless, can be used to calibrate a Stone-Geary function (Yu et al., 2004). For developed countries, Yu et al. (2004) show that results of models using the AIDADS function with it's own elasticities are similar to those models calibrating a Stone-Geary function on AIDADS based elasticities.

The sensitivity analysis shows that the model, in general, is robust to a change in behavioral parameters. Altering substitution elasticities between capital and labor or applying other expenditure elasticities alters the results only slightly. The impact of migration and remittances is somewhat higher using the expenditure elasticities of Reimer and Hertel (2003) compared to that of Hertel et al. (2012) while wage effects are slightly smaller. The substitution elasticities of Okagawa and Ban (2008) increase production in the construction sector and reduce production slightly in most other sectors. The model is more sensitive to changes in the Armington elasticities. While the high-estimated elasticities of Saito (2004) and Donnelly et al. (2004) do only scarcely alter the results compared to the elasticities of Hertel et al. (2012), the low-estimated elasticities

ties of Welsch (2008) reduce the impact of remittances and migration on trade. By using these estimates, products from foreign countries get less substitutable among each other and the trading share with intra EMU-countries increases while that with extra-EMU countries shrinks. Given that the impact on trade is reduced and, compared to the standard calibration, production shifts from tradable goods to non-tradable more labour intensive goods, investment demand is reduced and we see a weaker GDP growth. The overall results of the model, that remittances impose a Dutch-disease like effect by benefiting the export sectors, nevertheless, still holds with low-estimated Armington elasticities.

## 5. Conclusion

Over the next decade, migration to Germany is likely to increase due to a high number of refugees, immigration policies intended to reduce the effects of its aging society and its increasingly prosperous economic conditions. Concerns surrounding increasing remittances trigger fears that migration may harm the domestic economy. Among host country citizens the outflow of remittances is often seen as an outflow of purchasing power. To address this issue we introduce remittances in a dynamic general equilibrium model with altruistic agents. We are able to estimate an altruism coefficient as we can use the SOEP data to provide unique information on individual remittances. This coefficient is used to endogenize remittances as a decision on the second nest of the utility function. Using this model, we are able to show that remittances trigger an opposite Dutch disease effect by benefiting the export industry and increasing GDP. This even holds true in the setting of a currency union, where the exchange-rate pass through differs from the standard two-country setting.

The behavior of migrants is critical for determining the effect on the size of remittances. Our empirical estimates show that remittance flows are determined by migrants' plans for temporary or permanent migration. Temporary migrants are likely to remit more than twice the amount of money as permanent migrants, increasing the impact on macroeconomic variables such as GDP, trade, private consumption, and investment. We expect temporary migration to increase because of the liberalized labor market access granted to EU citizens from countries acceding in 2004 and 2007. Therefore, remittances should play an increasingly important role in the future.

The interrelated fear of a loss of purchasing power cannot be rejected for all sectors. In some service sectors, we calculate a decline in production and a loss in employment due to a shift in resources to tradable sectors. Other service sectors that are closer to the manufacturing sector, and sectors which provide resources to the manufacturing sector, tend to benefit. The increase in remittances increases the demand for labor, which may result in more people working in tradable-goods sectors and higher average wages.

## References

- Acharya, C. P., Leon-Gonzalez, R., 2014. How do migration and remittances affect human capital investment? the effects of relaxing information and liquidity constraints. *Journal of Development Studies* 50 (3), 444–460.
- Acosta, P. A., Lartey, Emmanuel K. K., Mandelman, F. S., 2009. Remittances and the dutch disease. *Journal of International Economics* 79 (1), 102–116.
- Adam, K., Jappelli, T., Menichini, A., Padula, M., Pagano, M., 2002. Analyse, compare, and apply alternative indicators and monitoring methodologies to measure the evolution of capital market integration in the european union. Report to the European Commission ETD/2001/B5 - 3001/A/29.
- Aggarwal, R., Demirguc-Kunt, A., Martinez Peria, M. S., 2011. Do remittances promote financial development? *Journal of Development Economics* 96 (2), 255–264.
- Akkoyunlu, S., Kholodilin, K. A., 2008. A link between workers' remittances and business cycles in germany and turkey. *Emerging Markets Finance and Trade* 44 (5), 23–40.
- Amuedo-Dorantes, C., Pozo, S., 2004. Workers' remittances and the real exchange rate: A paradox of gifts. *World Development* 32 (8), 1407–1417.
- Amuedo-Dorantes, C., Pozo, S., 2006. Remittances as insurance: Evidence from mexican immigrants. *Journal of Population Economics* 19 (2), 227–254.
- Arellano, M., Carrasco, R., 2003. Binary choice panel data models with predetermined variables. *Journal of Econometrics* 115 (1), 125–157.
- Arezki, R., Bruckner, M., 2012. Rainfall, financial development, and remittances: Evidence from sub-saharan africa. *Journal of International Economics* 87 (2), 377–385.
- Athukorala, P., Riedel, J., 1994. Demand and supply factors in the determination of nie exports: A simultaneous error-correction model for hong kong: A comment. *The Economic Journal* 104 (427), 1411–1414.
- Bilgic, A., King, S. A., Lusby, A. K., Schreiner, D. F., 2002. Estimates of u.s. regional commodity trade elasticities of substitution. *Journal of Regional Analysis and Policy* 32 (2).
- Borjas, G. J., 1995. The economic benefits from immigration. *The Journal of Economic Perspectives* 9 (2), 3–22.
- Borjas, G. J., 2013. The analytics of the wage effect of immigration. *IZA Journal of Migration* 2.
- Bourdet, Y., Falck, H., 2006. Emigrants' remittances and dutch disease in cape verde. *International Economic Journal* 20 (3), 267–284.



- Bourguignon, F., 2006. International migration, remittances, and the brain drain: Foreword. In: Ozden, C., Schiff, M. (Eds.), *International Migration, Remittances, and the Brain Drain*. Trade and Development Series and Washington, D.C and World Bank and Houndmills, U.K. and New York and Palgrave Macmillan, pp. ix–x.
- Brücker, H., Hauptmann, A., Jahn, E. J., Upward, R., 2014. Migration and imperfect labor markets: Theory and cross-country evidence from denmark, germany and the uk. *European Economic Review* 66 (0), 205–225.
- Carling, J., 2008. The determinants of migrant remittances. *Oxford Review of Economic Policy* 24 (3), 581–598.
- Cassoni, A., Flores, M., 2008. Methodological shortcomings in estimating armington elasticities. University Library of Munich, MPRA Paper (34544).
- Clemens, M. A., Ozden, C., Rapoport, H., 2015. Migration and development research is moving far beyond remittances (2014). *World Development* 65, 1–5.
- Cottle, R. W., Pang, J.-S., Stone, R. E., 2009. The linear complementarity problem. Society for Industrial & Applied.
- Donnelly, W. A., Johnson, K., Tsigas, M. E., Ingersoll, D. L., 2004. Revised armington elasticities of substitution usitc model and the concordance for constructing consistent set for the gtap model. United States International Trade Commission, Working Paper (15861).
- Dustmann, C., 2000. Temporary migration and economic assimilation. *Swedish Economic Policy Review* 2000 (7).
- Dustmann, C., Glitz, A., Frattini, T., 2008. The labour market impact of immigration. *Oxford Review of Economic Policy* 24 (3), 477–494.
- Dustmann, C., Kirchkamp, O., 2002. The optimal migration duration and activity choice after re-migration. *Journal of Development Economics* 67 (2), 351–372.
- Dustmann, C., Mestres, J., 2010. Remittances and temporary migration. *Journal of Development Economics* 92 (1), 62–70.
- Dzansi, J., 2013. Do remittance inflows promote manufacturing growth? *Annals of Regional Science* 51 (1), 89–111.
- Fajnzylber, P., Lopez, J. H. (Eds.), 2008. *Remittances and development: Lessons from latin america*. Latin American Development Forum Series. Washington, D.C.: World Bank.
- Feenstra, R., Luck, P., Obstfeld, M., Russ, K. N., 2014. In search of the armington elasticity.  
URL <http://www.cepr.org/pubs/dps/DP9951.asp>

- Funkhouser, E., 1995. Remittances from international migration: A comparison of el salvador and nicaragua. *Review of Economics and Statistics* 77 (1), 137–146.
- Hanson, G. H., 2007. Emigration, remittances and labor force participation in mexico. *Integration and Trade* 11 (27), 73–103.
- Hertel, T. W., Badri, N. G., McDougall, R. A., 2012. Behavioral parameters. In: Badri Narayanan, Angel Aguiar and Robert McDougall (Ed.), *Global Trade, Assistance, and Production*.
- Hoddinott, J., 1994. A model of migration and remittances applied to western kenya. *Oxford Economic Papers* 46 (3), 459–476.
- Hummels, D., 1999. Toward a geography of trade costs. GTAP Working Paper (17).  
URL [http://www.gtap.agecon.purdue.edu/resources/res\\_display.asp?RecordID=1162](http://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=1162)
- Iranzo, S., Peri, G., 2009. Migration and trade: Theory with an application to the eastern–western european integration. *Journal of International Economics* 79 (1), 1–19.
- Ivanova Nadezhda, 2005. Estimation of own- and cross-price elasticities of disaggregated imported and domestic goods in russia. EERC Working Paper Series (05-13e).
- Johnson, G. E., Whitelaw, W. E., 1974. Urban-rural income transfers in kenya: An estimated-remittances function. *Economic Development and Cultural Change* 22 (3), 473–479.
- Koesler, S., Schymura, M., 2012. Substitution elasticities in a ces production framework: An empirical analysis on the basis of non-linear least squares estimations. ZEW Discussion Paper (12-007).
- La Briere, B. d., 2002. The roles of destination, gender, and household composition in explaining remittances: An analysis for the dominican sierra. *Journal of Development Economics* 68 (2), 309–328.
- Lartey, E. K. K., 2013. Remittances, investment and growth in sub-saharan africa. *Journal of International Trade and Economic Development* 22 (7-8), 1038–1058.
- Lartey, E. K. K., Mandelman, F. S., Acosta, P. A., 2012. Remittances, exchange rate regimes and the dutch disease: A panel data analysis. *Review of International Economics* 20 (2), 377–395.
- Lopez-Cordova, J. E., Olmedo, A., 2007. International migration, remittances and development: An overview. *Integration and Trade* 11 (27), 1–19.

- Lucas, R. E. B., Stark, O., 1985. Motivations to remit: Evidence from botswana. *Journal of Political Economy* 93 (5), 901–918.
- Mandelman, F. S., 2013. Monetary and exchange rate policy under remittance fluctuations. *Journal of Development Economics* 102, 128–147.
- Mandelman, F. S., Zlate, A., 2012. Immigration, remittances and business cycles. *Journal of Monetary Economics* 59 (2), 196–213.
- McCormick, B., Wahba, J., 2000. Overseas employment and remittances to a dual economy. *Economic Journal* 110 (463), 509–534.
- McDaniel, C. A., Balistreri, E. J., 2003. A review of armington trade substitution elasticities: 7 / 18. *Integration and Trade*, 161–173.  
URL <http://www.iadb.org/intal/intalcdi/0brasDigitalizadas.aspx?subbase=INTEG.TRADE.clase=R>
- McKittrick, R. R., 1998. The econometric critique of computable general equilibrium modeling: the role of functional forms. *Economic Modelling* 15 (4), 543–573.
- Melkonyan, T. A., Grigorian, D. A., 2012. Microeconomic implications of remittances in an overlapping generations model with altruism and a motive to receive inheritance. *Journal of Development Studies* 48 (8), 1026–1044.
- Okagawa, A., Ban, K., 2008. Estimation of substitution elasticities for cge models. Osaka University, Discussion Papers in Economics and Business (08-16).  
URL <https://ideas.repec.org/p/osk/wpaper/0816.html>
- Pesaran, H. M., 2003. Aggregation of linear dynamic models: An application to life-cycle consumption models under habit formation. *Economic Modelling* 20 (2), 383–415.
- Rapoport, H., Docquier, F., 2006. The economics of migrants' remittances. *Handbook on the Economics of Giving, Reciprocity and Altruism* 2, 1135–1198.
- Reimer, J., Hertel, T., 2003. International cross section estimates of demand for use in the gtap model. GTAP Working Paper (22).  
URL [http://www.gtap.agecon.purdue.edu/resources/res\\_display.asp?RecordID=1190](http://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=1190)
- Riedel, J., 1988. The demand for ldc exports of manufactures: Estimates from hong kong. *The Economic Journal* 98 (389), 138–148.
- Roodman, D., 2009. How to do xtabond2: An introduction to difference and system gmm in stata. *Stata Journal* 9 (1), 86–136.
- Ruhl, K. J., 2008. The international elasticity puzzle. New York University Working Paper.  
URL <http://kimruhl.squarespace.com/storage/RuhlElasticity.pdf>

- Rutherford, T. F., 1995. Extension of gams for complementarity problems arising in applied economic analysis. *Journal of Economic Dynamics and Control* 19 (8), 1299–1324.
- Saito, M., 2004. Armington elasticities in intermediate inputs trade: a problem in using multilateral trade data. *The Canadian Journal of Economics/Revue canadienne d'Economie* 37 (4), 1097–1117.
- Sana, M., Massey, D. S., 2005. Household composition, family migration, and community context: Migrant remittances in four countries. *Social Science Quarterly* 86 (2), 509–528.
- Shiells, C. R., Stern, R. M., Deardorff, A. V., 1986. Estimates of the elasticities of substitution between imports and home goods for the united states. *Weltwirtschaftliches Archiv* 122 (3), 497–519.
- Shimada, A., 2012. Migration decisions, expected remittances, and altruism. *International Review of Economics* 59 (3), 285–296.
- Stark, O., 1995. *Altruism and beyond: An economic analysis of transfers and exchanges within families and groups*. Cambridge Univ. Pr.
- Stark, O., Lucas, Robert E. B., 1988. Migration, remittances, and the family. *Economic Development and Cultural Change* 36 (3), 465–481.
- van Dalen, H. P., Groenewold, G., Fokkema, T., 2005. The effect of remittances on emigration intentions in egypt, morocco, and turkey. *Population Studies* 59 (3), 375–392.
- Vargas-Silva, C., 2009. The tale of three amigos: Remittances, exchange rates, and money demand in mexico. *Review of Development Economics* 13 (1), 1–14.
- Wagner, G. G., Joachim R. Frick, Jürgen Schupp, 2007. The german socio-economic panel study (soep) - scope, evolution and enhancements. *Schmollers Jahrbuch* 127:139-169.
- Welsch, H., 2008. Armington elasticities for energy policy modeling: Evidence from four european countries: 30 / 5. *Energy Economics*, 2252–2264.  
URL <http://www.sciencedirect.com/science/journal/01409883>
- World Bank, 2016. *Migration and Remittances Factbook 2016*. World Bank.
- Yu, W., Hertel, T. W., Preckel, P. V., Eales, J. S., 2004. Projecting world food demand using alternative demand systems. *Economic Modelling* 21 (1), 99–129.

## 6. Appendix

### 6.1. Tables and figures

Table 1: Household characteristics and remittances

	Annual post gov- ernment household income	Remittances		
		Annual amount remitted	Percentage of migrants remitting	Percentage of household income remitted
All migrant households	31808.7	590.3	17.0	1.9
Household head is employed in full time	37743.6	810.4	21.5	2.1
Household head is part-time employed or unemployed	25078.7	340.6	11.9	1.4
Female household head	26314.6	309.9	13.5	1.2
Male household head	33740.5	688.8	18.2	2.0
Single household	18622.0	361.1	12.1	1.9
Household head lives with partner in host country	35860.0	660.7	18.5	1.8
Household head has temporary migration plans	33373.4	1107.9	20.7	3.3
Household head has permanent migration plan	31226.3	397.6	15.6	1.3
N	13969			

Notes: Descriptive information derived from SOEP data on migrants' remittance behavior for different household types, indicating migrants' annual post government household income, the annual amount remitted, the percentage of migrant households who remit, and the percentage of migrants' annual incomes that are spent on remittances.

Table 2: Household remitted OLS and GMM Models

	Model I		Model II	
	OLS	GMM	OLS	GMM
Temporary migration plan	0.061*** (0.013)	0.027*** (0.008)	0.061*** (0.013)	0.029*** (0.008)
Yt-1		0.354*** (0.018)		0.352*** (0.018)
<b>Household heads characteristics</b>				
Age at immigration/10	0.008 (0.005)	0.008+ (0.004)	0.012* (0.005)	0.010* (0.004)
Years since migration/10	-0.027*** (0.007)	-0.023*** (0.006)	-0.022*** (0.006)	-0.019*** (0.006)
Female	0.007 (0.016)	0.004 (0.013)	-0.009 (0.018)	-0.009 (0.015)
Education in years	0.004 (0.003)	0.002 (0.002)	0.003 (0.003)	0.001 (0.002)
Employed full-time	0.064*** (0.013)	0.044*** (0.010)	0.069*** (0.013)	0.046*** (0.010)
Lives with a partner in host country	0.047** (0.018)	0.030* (0.014)	-0.006 (0.044)	-0.026 (0.035)
<b>Household characteristics</b>				
Log(Household income)	0.069*** (0.011)	0.044*** (0.009)	0.056*** (0.010)	0.037*** (0.008)
Households members in host country	-0.021*** (0.006)	-0.015** (0.005)	-0.017** (0.006)	-0.011* (0.005)
Children in host country household	-0.019 (0.016)	0.008 (0.013)	-0.017 (0.016)	0.008 (0.014)
<b>Partners' characteristics</b>				
Partner employed in full-time			0.051** (0.019)	0.031* (0.015)
Partners' education			0.003 (0.004)	0.004 (0.003)
Observation	13969	11051	13969	11051
Households		1773		1773

+  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

SOEP data from 1996-2011. Year dummies included. In the OLS specification additional continent dummies are included and standard errors are clustered by households. In the GMM Models temporary migration plans are instrumented with "internal" instruments using the lag of the instrumented variable. Additional test for GMM Models: Model I: Household remitted: AR(1):  $z = -16.15$  Pr >  $z = 0.000$ ; AR(2):  $z = 3.47$  Pr >  $z = 0.001$ ; Hansen test:  $\chi^2(134) = 139.45$  Prob >  $\chi^2 = 0.356$ ; Model II: Household remitted: AR(1):  $z = -16.16$  Pr >  $z = 0.000$ ; AR(2):  $z = 3.47$  Pr >  $z = 0.001$ ; Hansen test:  $\chi^2(135) = 142.06$  Prob >  $\chi^2 = 0.322$

Table 3: Amount remitted OLS and GMM Models

	Model I		Model II	
	OLS	GMM	OLS	GMM
Temporary migration plan	0.521*** (0.099)	0.229*** (0.060)	0.520*** (0.099)	0.315*** (0.074)
Yt-1		0.364*** (0.019)		0.088*** (0.022)
<b>Household heads characteristics</b>				
Age at immigration/10	0.060 (0.038)	0.066* (0.031)	0.087* (0.038)	0.046 (0.041)
Years since migration/10	-0.169*** (0.049)	-0.120** (0.038)	-0.137** (0.052)	-0.207*** (0.053)
Female	0.059 (0.116)	0.049 (0.094)	-0.060 (0.127)	-0.024 (0.136)
Education in years	0.028 (0.020)	0.022 (0.015)	0.027 (0.021)	0.016 (0.021)
Employed full-time	0.492*** (0.096)	0.335*** (0.069)	0.533*** (0.095)	0.386*** (0.081)
Lives with a partner in host country	0.421*** (0.128)	0.250* (0.099)	0.117 (0.321)	-0.184 (0.329)
<b>Household characteristics</b>				
Log(Household income)	0.550*** (0.083)	0.310*** (0.064)	0.456*** (0.078)	0.312*** (0.075)
Households members in host country	-0.179*** (0.045)	-0.110** (0.035)	-0.150*** (0.045)	-0.103* (0.044)
Children in host country household	-0.163 (0.118)	0.076 (0.094)	-0.143 (0.118)	-0.044 (0.118)
<b>Partners' characteristics</b>				
Partner employed in full-time			0.397** (0.145)	0.179 (0.139)
Partners' education			0.013 (0.028)	0.042 (0.028)
Observation	13969	11051	13969	11051
Households		1773		1773

<sup>+</sup>  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

SOEP data from 1996-2011. Year dummies included. In the OLS specification additional continent dummies are included and standard errors are clustered by households. In the GMM Models temporary migration plans are instrumented with "internal" instruments using the lag of the instrumented variable. Additional test for GMM Models: Model I: Amount remitted: AR(1):  $z = -15.12$   $\text{Pr} > z = 0.000$ ; AR(2) in first differences:  $z = 3.89$   $\text{Pr} > z = 0.000$ ; Hansen test:  $\text{chi2}(134) = 139.49$   $\text{Prob} > \text{chi2} = 0.355$ ; Model II: Amount remitted: AR(1):  $z = -14.57$   $\text{Pr} > z = 0.000$ ; AR(2):  $z = 1.15$   $\text{Pr} > z = 0.251$ ; Hansen test:  $\text{chi2}(134) = 127.28$   $\text{Prob} > \text{chi2} = 0.647$

Table 4: Migration flows 2000 to 2023

	Inflow	Outflow	Net migration
2000	841158	674038	+ 167120
2001	879217	606494	+ 272723
2002	842543	623255	+ 219288
2003	768975	626330	+ 142645
2004	780175	697632	+ 82543
2005	707352	628399	+ 78953
2006	661855	639064	+ 22791
2007	680766	636854	+ 43912
2008	682146	737889	- 55743
2009	721014	733796	- 12782
2010	798282	670605	+ 127677
2011	958299	678969	+ 279330
2012	1080936	711991	+ 368945
2013	1226493	797886	+ 428607
<b>Population projection<sup>17</sup></b>			
2014	1405327	905327	+ 500000
2015	1414225	914225	+ 500000
2016	1420014	920014	+ 500000
2017	1341252	891252	+ 450000
2018	1240014	840014	+ 400000
2019	1124155	774155	+ 350000
2020	998783	698783	+ 300000
2021	822224	617224	250000
2022	731639	531639	+ 200000
2023	646054	446054	+ 200000

Source: Federal Statistical Office / own calculations.



Table 5: *Key parameter values of the CGE model*

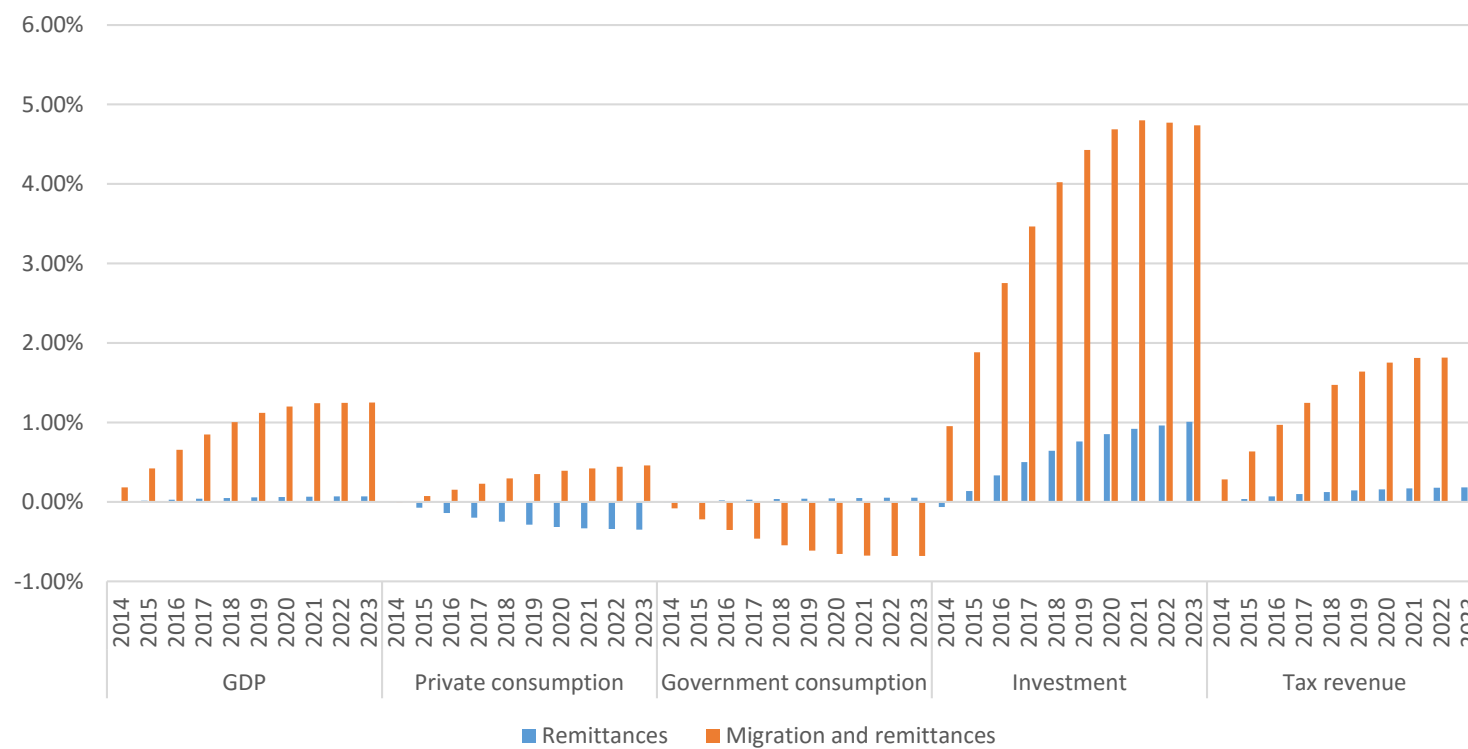
	Armington elasticities	Sub-Armington elasticities	Expenditure elasticities	Substitution elasticities
Agriculture, Forestry, Fishing	3.53	7.06	0.88	0.78
Mining and Quarring	2.07	4.14	0.98	0.27
Manufacturing	2.30	4.60	1.03	0.64
Electricity, Gas, Steam and Air Conditioning Supply	2.80	5.60	0.98	1.20
Water Supply; Sewerage, Waste management and remediation activities	2.80	5.60	0.98	1.20
Construction	1.90	3.80	0.98	0.71
Wholesale and retail trade; Repair of motor vehicles and motorcycles	1.90	3.80	1.06	0.83
Transportation and storage	1.90	3.80	0.99	0.84
Accommodation and food service activities	1.90	3.80	1.06	1.10
Information and Communication	1.90	3.80	0.99	1.18
Financial and insurance activities	1.90	3.80	1.08	1.03
Real estate activities	1.90	3.80	1.08	1.33
Professional, scientific and technical activities	1.90	3.80	1.08	0.66
Administrative and support service activities	1.90	3.80	1.06	1.12
Public administration and defence; Compulsory social security	1.90	3.80	1.06	1.12
Education	1.90	3.80	1.06	1.15
Human health and social work activities	1.90	3.80	1.06	0.97
Arts, entertainment and recreation	1.90	3.80	1.06	0.88
Other service activities	1.90	3.80	1.06	0.88
Activities of households as employers; Undifferentiated goods- and service producing activities	1.90	3.80	0.99	0.88

Table 6: *Sensitivity analysis (not for publication)*

	Armington elasticities (Saito 2004)	Armington elasticities (Donnelly et al. 2004)	Substitution elasticities (Okagawa and Ban 2008)	Expenditure elasticities (Reimer and Hertel 2004)
Agriculture, Forestry, Fishing	6.43	4.20	0.02	0.59
Mining and Quarring	1.45	2.80	0.14	1.067
Manufacturing	2.10	3.50	0.36	0.872
Electricity, Gas, Steam and Air Conditioning Supply	2.80	2.80	0.46	1.067
Water Supply; Sewerage, Waste management and remediation activities	2.80	2.80	0.46	1.067
Construction	1.90	1.90	0.07	1.067
Wholesale and retail trade; Repair of motor vehicles and motorcycles	1.90	1.90	0.32	1.119
Transportation and storage	1.90	1.90	0.31	0.965
Accommodation and food service activities	1.90	1.90	0.32	1.186
Information and Communication	1.90	1.90	0.37	1.119
Financial and insurance activities	1.90	1.90	0.26	1.218
Real estate activities	1.90	1.90	0.26	1.218
Professional, scientific and technical activities	1.90	1.90	0.32	1.218
Administrative and support service activities	1.90	1.90	0.32	1.186
Public administration and defence; Compulsory social security	1.90	1.90	0.32	1.186
Education	1.90	1.90	0.32	1.186
Human health and social work activities	1.90	1.90	0.32	1.186
Arts, entertainment and recreation	1.90	1.90	0.32	1.186
Other service activities	1.90	1.90	0.32	1.186
Activities of households as employers; Undifferentiated goods- and service producing activities	1.90	1.90	0.32	0.965

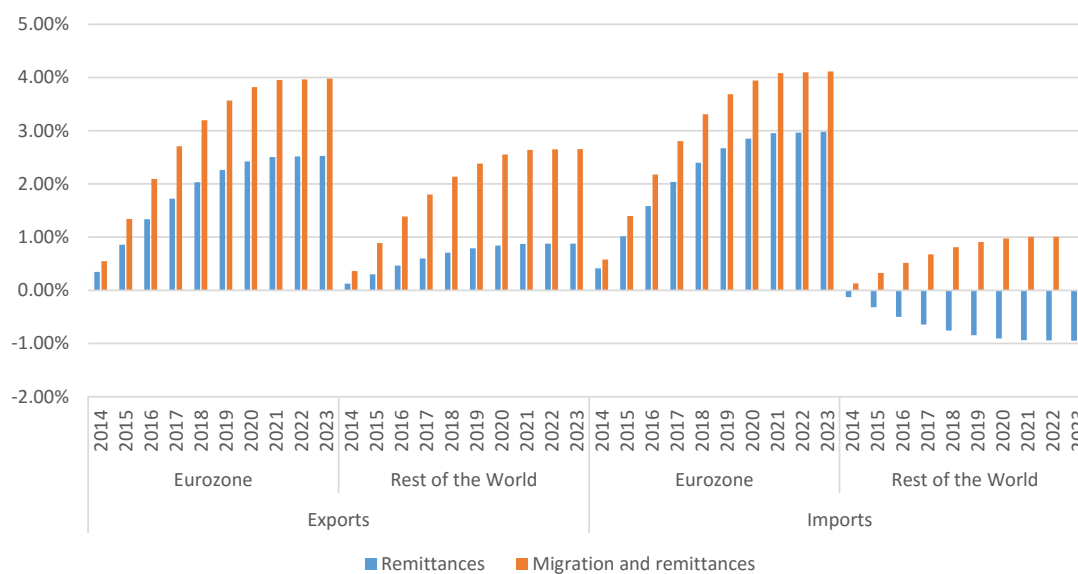


Figure 1: Key macroeconomic variables



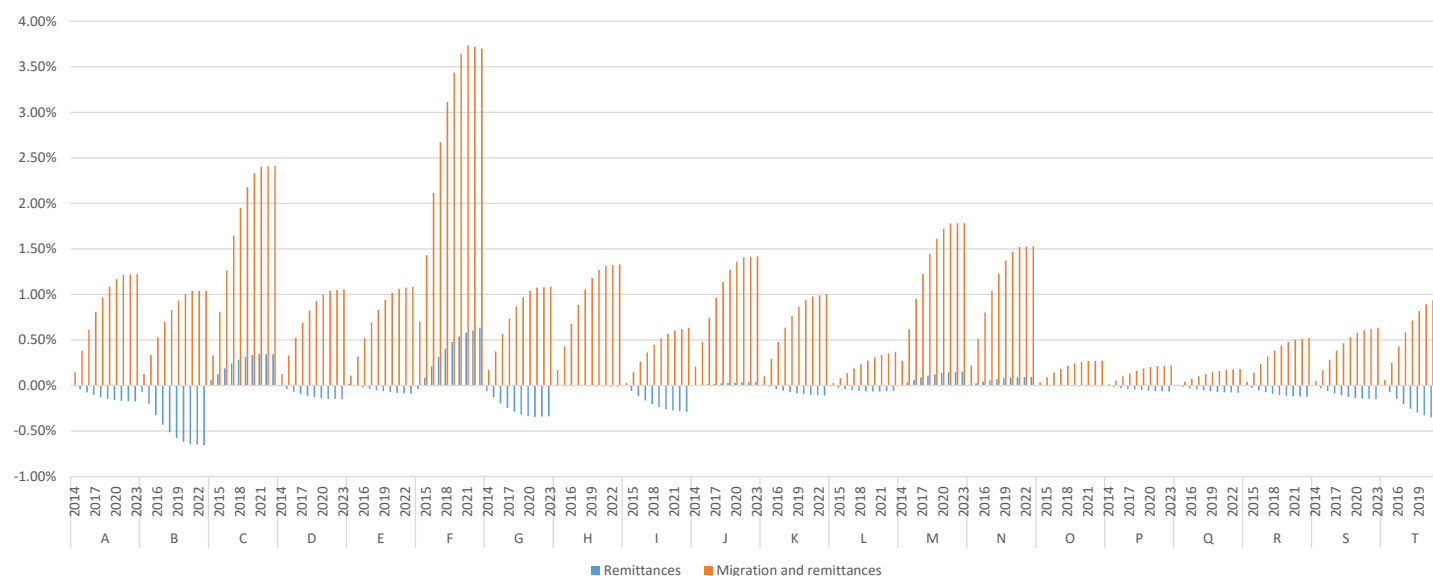
Notes: Simulation of an increase in migration according to Table 4 for the period 2014 to 2023. The remittances scenario shows the contribution of increasing remittances flows to the combined effect of migration and remittances. All variables are specified as deviations from the benchmark scenario in percent.

Figure 2: Trade



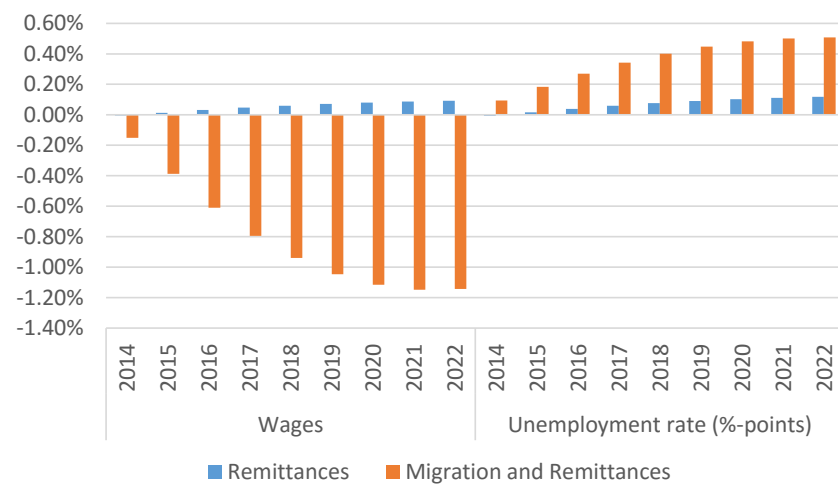
Notes: Simulation of an increase in migration according to Table 4 for the period 2014 to 2023. The remittances scenario shows the contribution of increasing remittances flows to the combined effect of migration and remittances. All variables are specified as deviations from the benchmark scenario in percent

Figure 3: GDP by industry



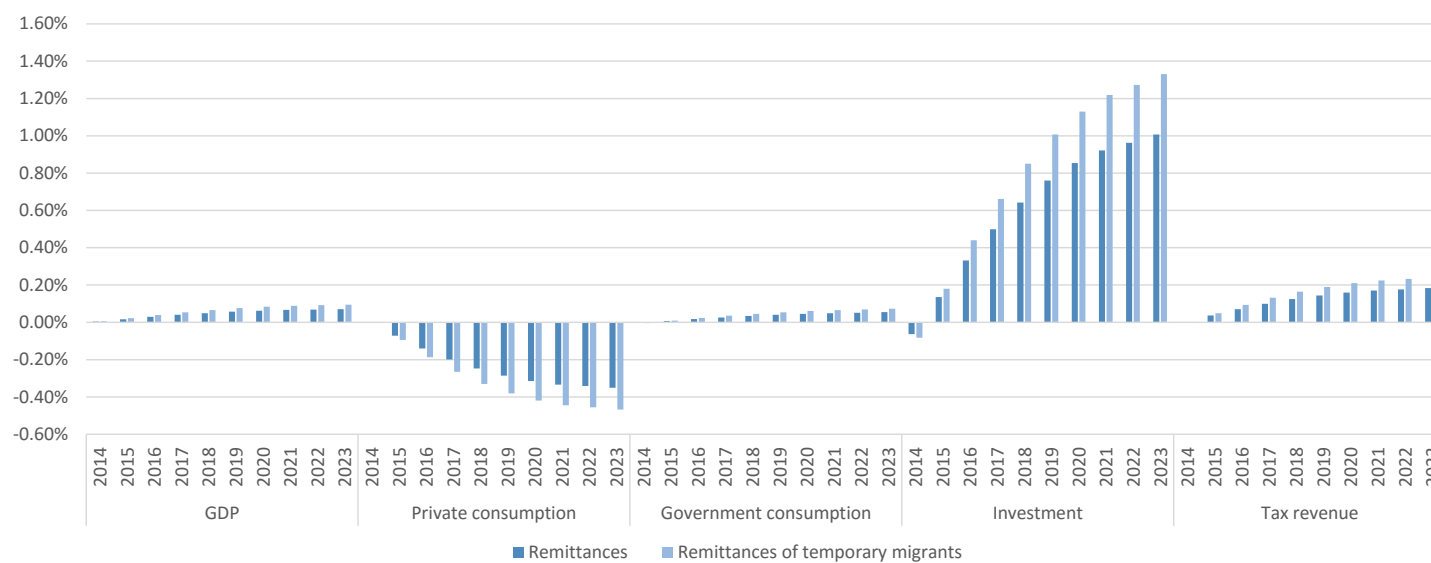
Notes: Simulation of an increase in migration according to Table 4 for the period 2014 to 2023. The remittances scenario shows the contribution of increasing remittances flows to the combined effect of migration and remittances. All variables are specified as deviations from the benchmark scenario in percent. Sectors are classified according to the NACE 2.0 scheme: A Agriculture; Forestry and fishing; B Mining and quarrying; C Manufacturing; D Electricity, gas, steam and air conditioning supply; E Water supply; Sewerage, waste management and remediation activities; F Construction; G Wholesale and retail trade; Repair of motor vehicles and motorcycles; H Transportation and storage; I Accommodation and food service activities; J Information and communication; K Financial and insurance activities; L Real estate activities; M Professional, scientific and technical activities; N Administrative and support service activities; O Public administration and defense; Compulsory social security; P Education; Q Human health and social work activities; R Arts, entertainment and recreation; S Other service activities; T Activities of households.

Figure 4: Labor market impact



Notes: Simulation of an increase in migration according to Table 4 for the period 2014 to 2023. The remittances scenario shows the contribution of increasing remittances flows to the combined effect of migration and remittances. Wages are specified as deviations from the benchmark scenario in percent, the unemployment rate is specified as deviations from the benchmark scenario in percentage points.

Figure 5: The impact of temporary migration



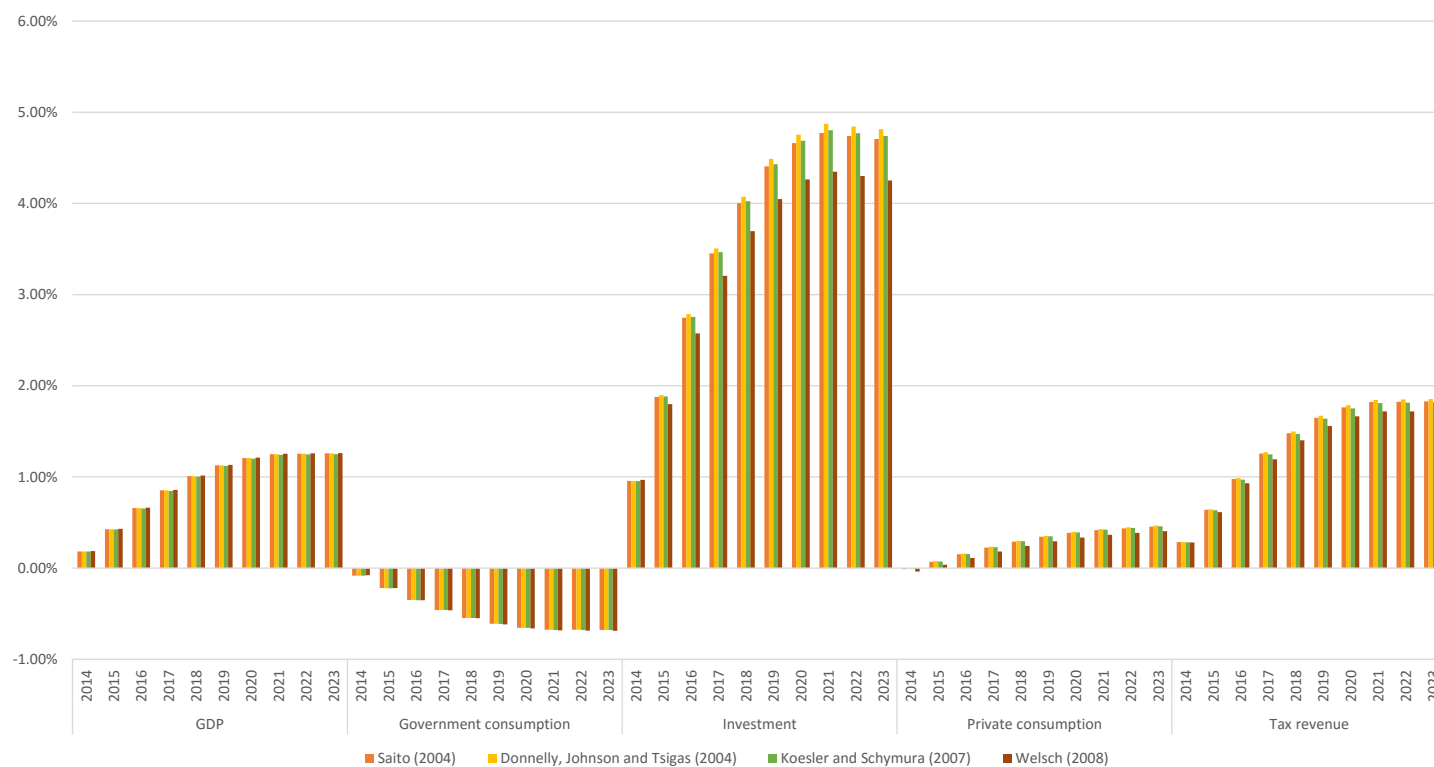
Notes: Simulation of the impact of an endogenous increase in remittances due to a migration shock (Table 4) for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent. The temporary migration scenario makes the counter-factual assumption that all migrants have temporary migration plans.





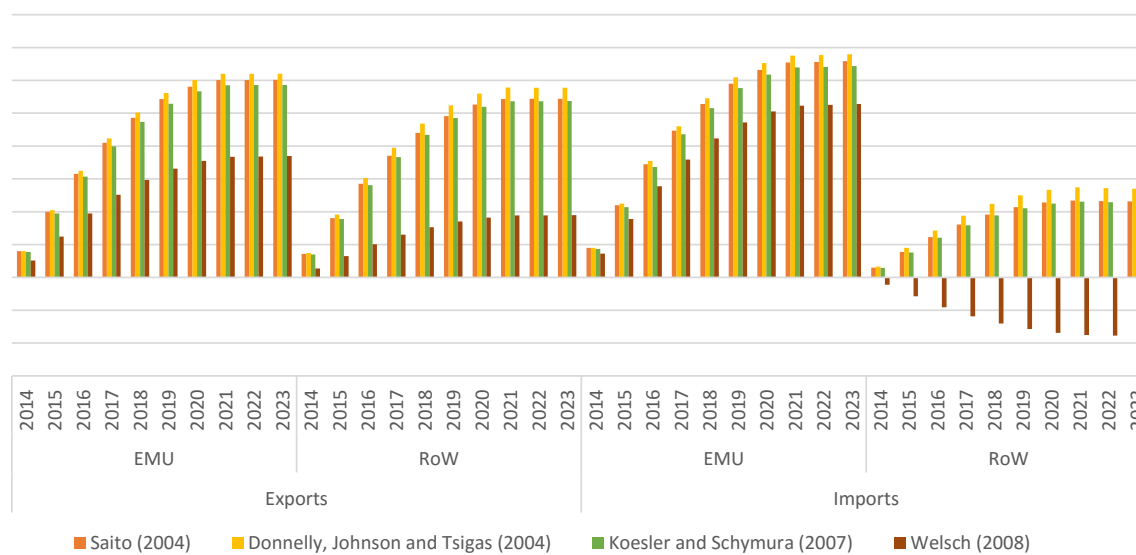
6.2. Supplement sensitivity analysis (not for publication)  
 6.2.1. Armington elasticities

Figure 6: Sensitivity analysis: Key macroeconomic variables

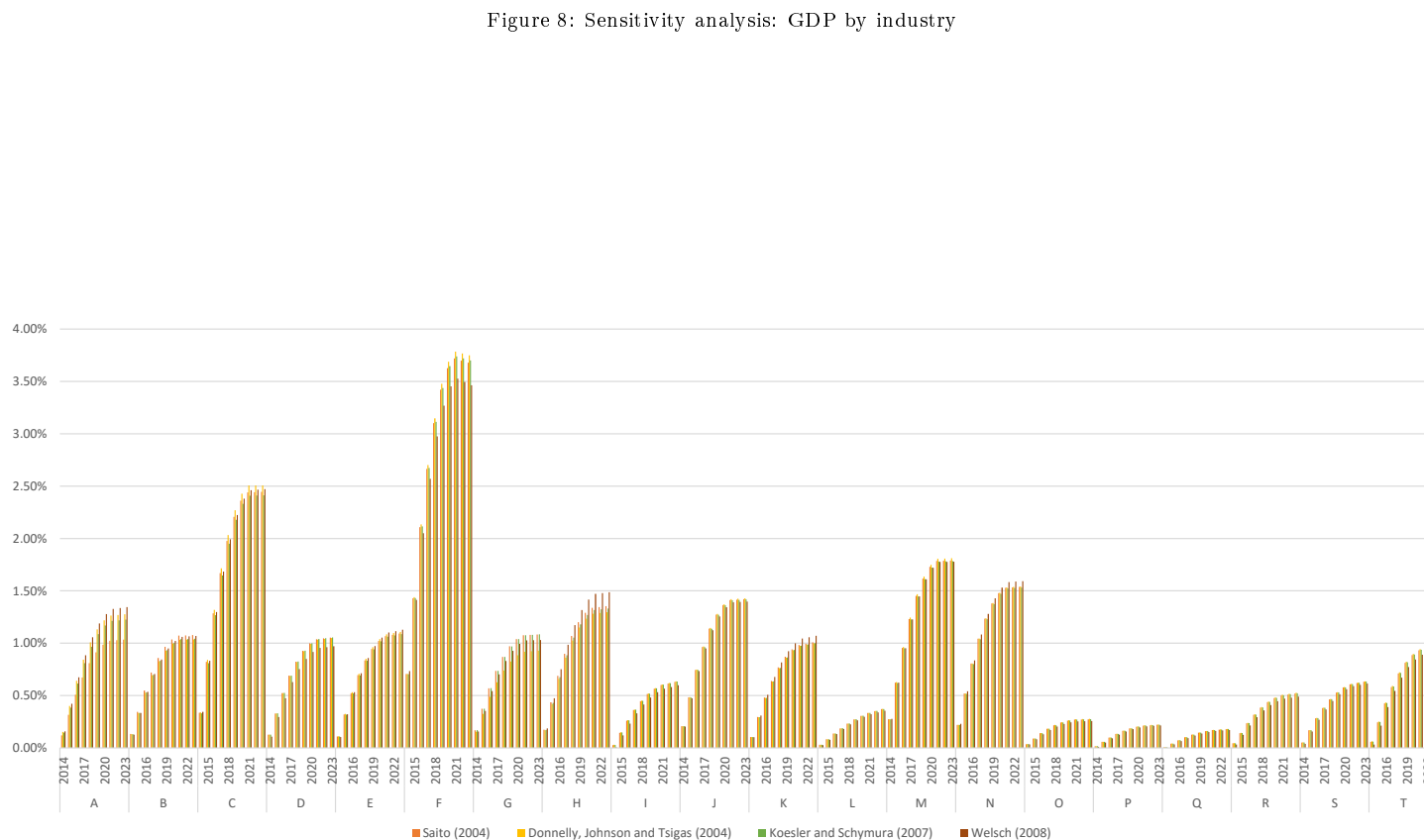


Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent.

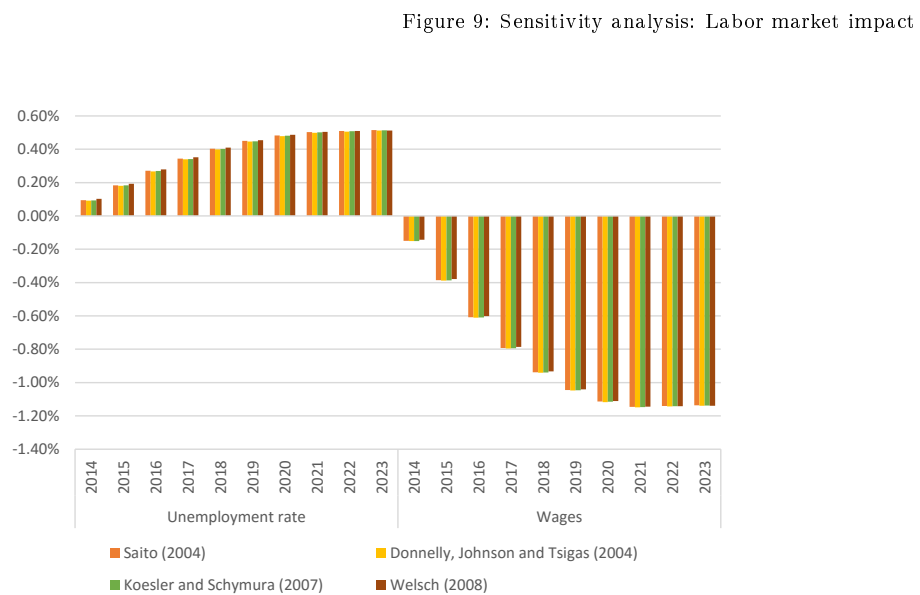
Figure 7: Sensitivity analysis: Trade



Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent

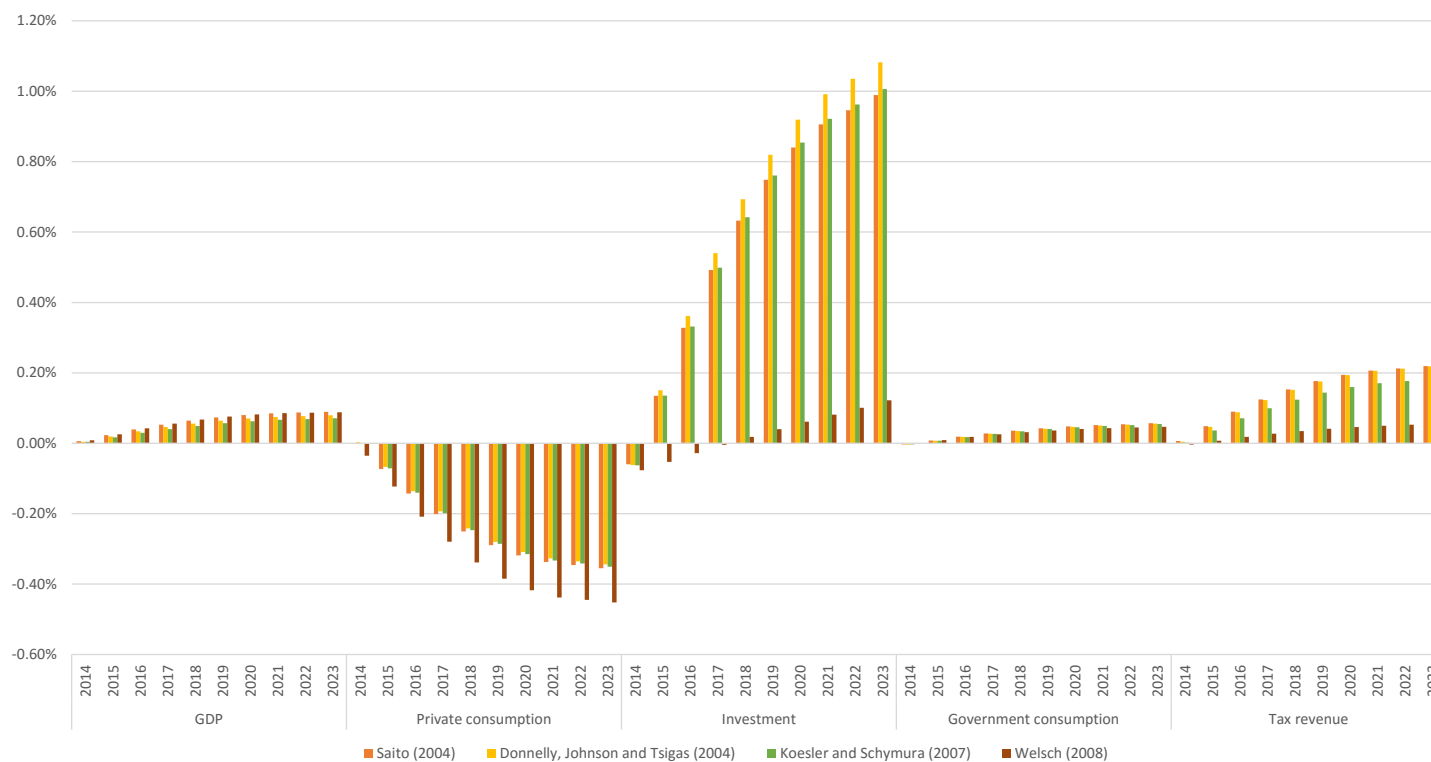


Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent. Sectors are classified according to the NACE 2.0 scheme: A Agriculture; Forestry and fishing; B Mining and quarrying; C Manufacturing; D Electricity, gas, steam and air conditioning supply; E Water supply; Sewerage, waste management and remediation activities; F Construction; G Wholesale and retail trade; Repair of motor vehicles and motorcycles; H Transportation and storage; I Accommodation and food service activities; J Information and communication; K Financial and insurance activities; L Real estate activities; M Professional, scientific and technical activities; N Administrative and support service activities; O Public administration and defense; Compulsory social security; P Education; Q Human health and social work activities; R Arts, entertainment and recreation; S Other service activities; T Activities of households.



Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. Wages are specified as deviations from the benchmark scenario in percent, the unemployment rate is specified as deviations from the benchmark scenario in percentage points.

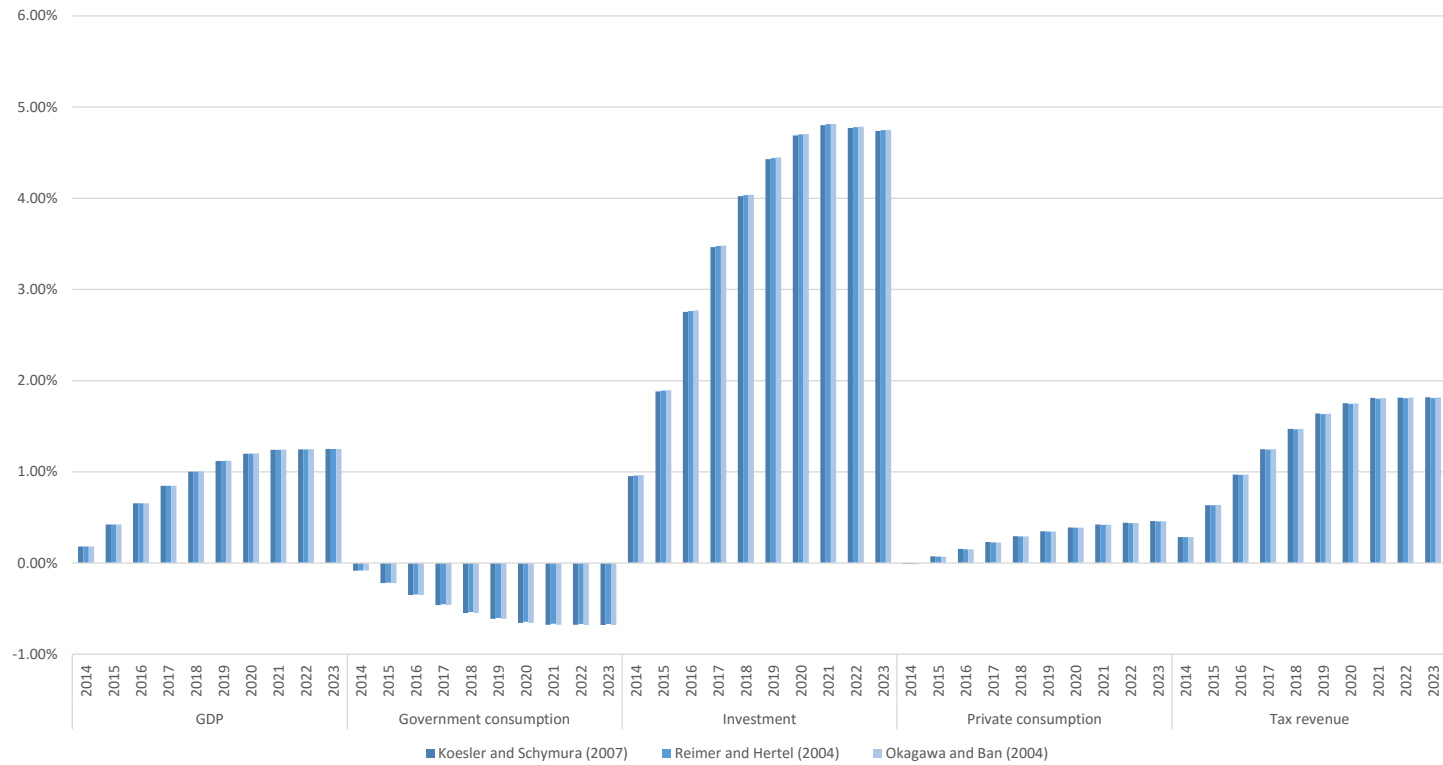
Figure 10: Sensitivity analysis: Remittances



Notes: Simulation of the impact of an endogenous increase in remittances due to an migration shock (Table 4) for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent.

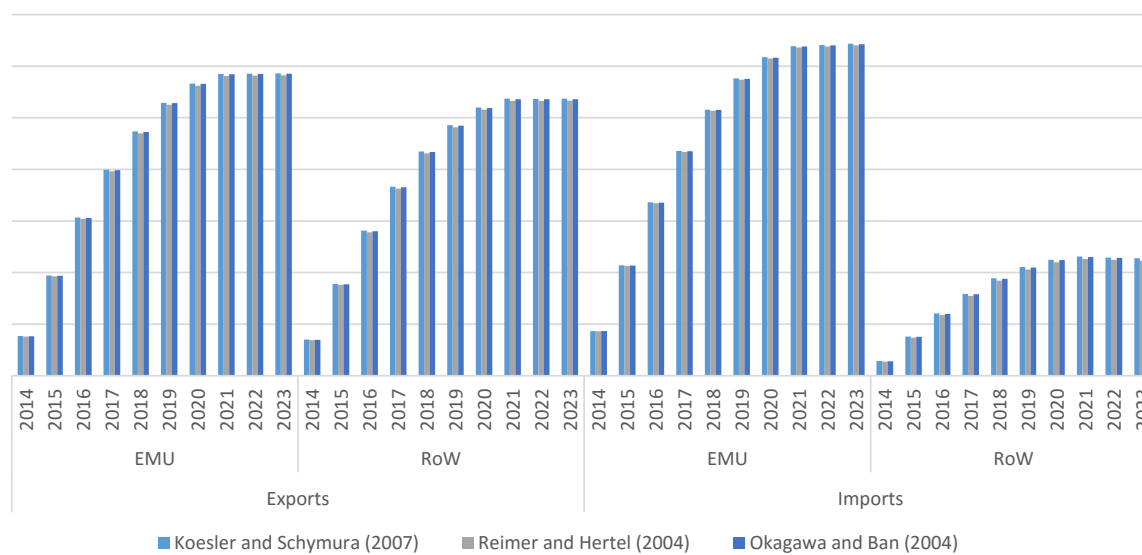
6.2.2. Other elasticities

Figure 11: Sensitivity analysis: Key macroeconomic variables



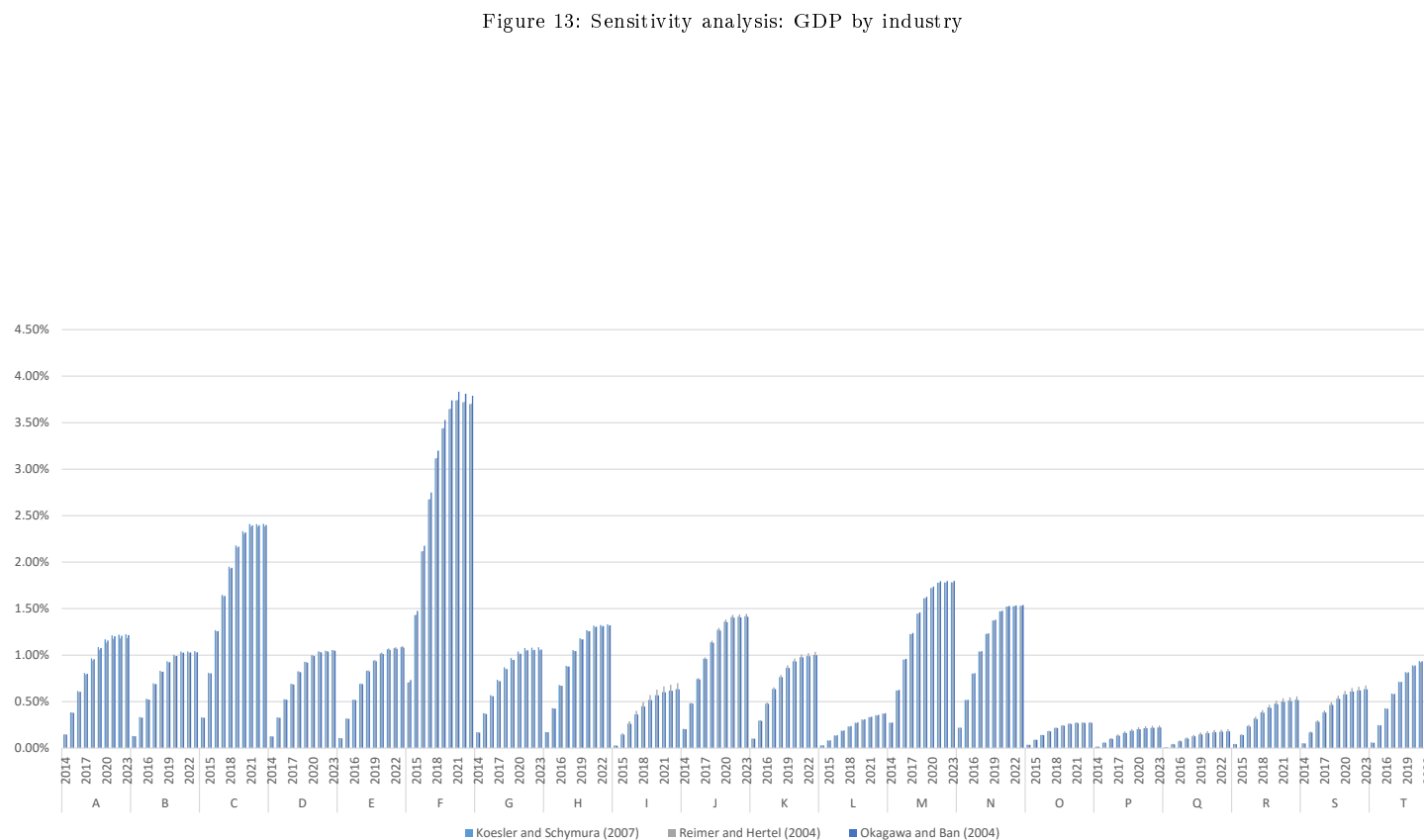
Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent.

Figure 12: Sensitivity analysis: Trade



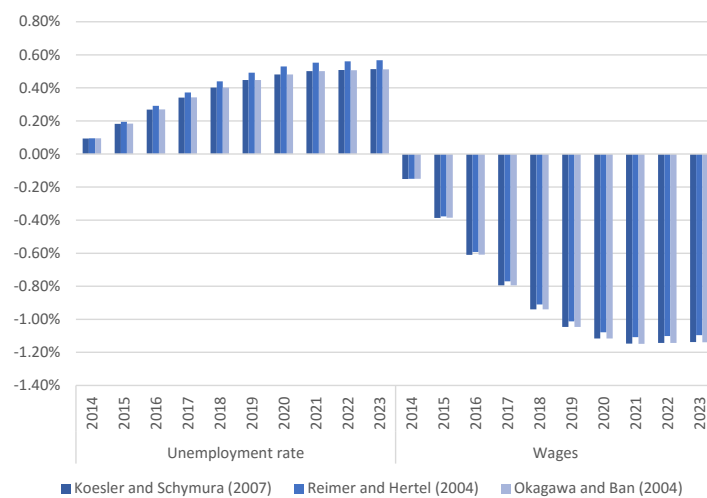
Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent





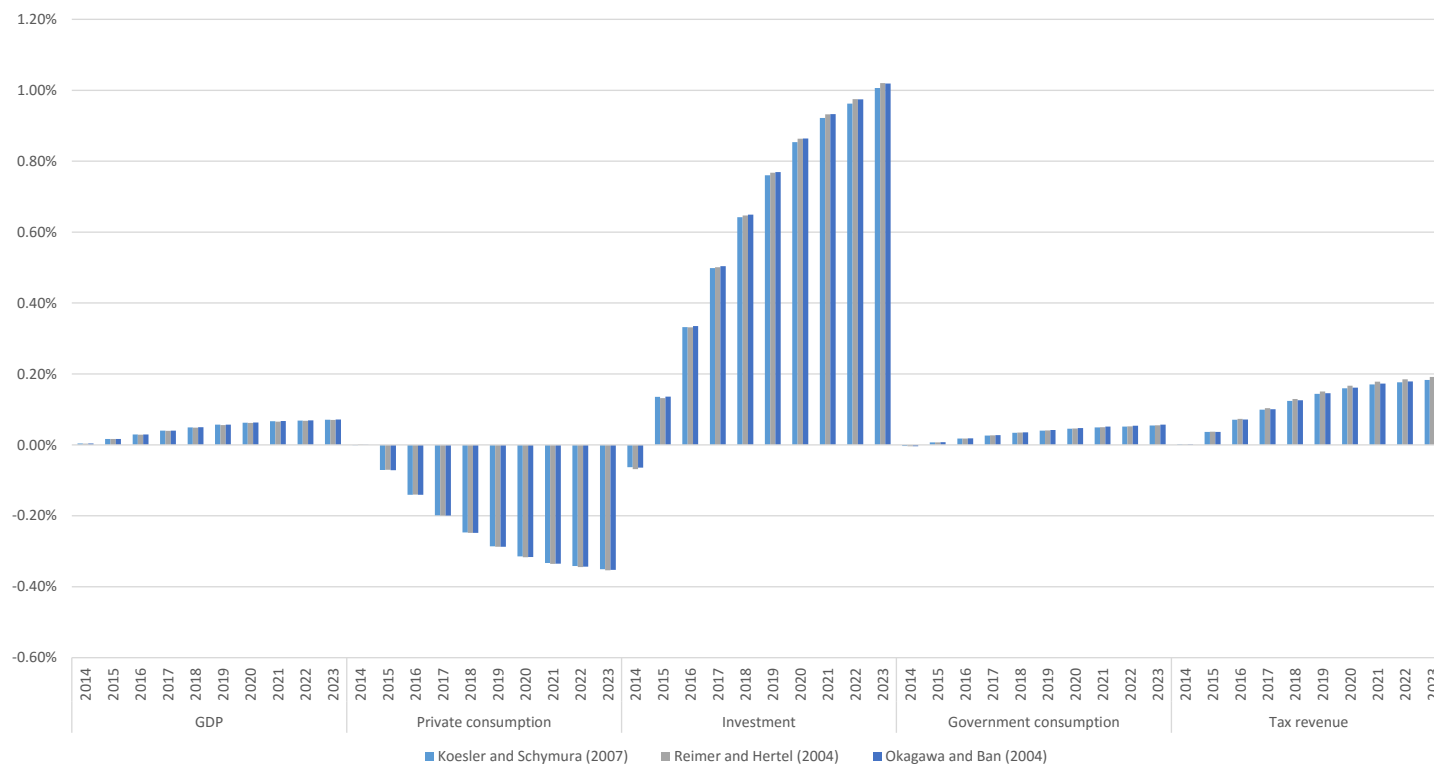
Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent. Sectors are classified according to the NACE 2.0 scheme: A Agriculture; Forestry and fishing; B Mining and quarrying; C Manufacturing; D Electricity, gas, steam and air conditioning supply; E Water supply; Sewerage, waste management and remediation activities; F Construction; G Wholesale and retail trade; Repair of motor vehicles and motorcycles; H Transportation and storage; I Accommodation and food service activities; J Information and communication; K Financial and insurance activities; L Real estate activities; M Professional, scientific and technical activities; N Administrative and support service activities; O Public administration and defense; Compulsory social security; P Education; Q Human health and social work activities; R Arts, entertainment and recreation; S Other service activities; T Activities of households.

Figure 14: Sensitivity analysis: Labor market impact



Notes: Simulation of an increase in migration and remittances according to Table 4 for the period 2014 to 2023. Wages are specified as deviations from the benchmark scenario in percent, the unemployment rate is specified as deviations from the benchmark scenario in percentage points.

Figure 15: Sensitivity analysis: Remittances



Notes: Simulation of the impact of an endogenous increase in remittances due to an migration shock (Table 4) for the period 2014 to 2023. All variables are specified as deviations from the benchmark scenario in percent.