NORFACE MIGRATION Discussion Paper No. 2012-21

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The Macroeconomic Impact of Remittances: A sending country perspective☆☆

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Abstract

Abstract Using data for Germany, we analyze the impact of migration and remittances by developing an open-economy general equilibrium model with heterogeneous households. Within the model, the flows of remittances depend on the altruism of households. Households with a higher altruism coefficient derive a higher utility from consumption of distant household members. Estimating the interrelation between household characteristic and remittances, we are able to derive altruism coefficients for different types of households. Applying the coefficients to our model, we show that remittances affect the macroeconomy primarily through the real exchange rate channel. Stronger remittances outflows depreciate the real exchange rate and give incentives to reallocate resources from the non-tradable towards tradable goods sectors. In the case of Germany, this translates into a converse 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[3] resulted in diminishing pecuniary and non-pecuniary costs of movement which strongly increased labor mobility and temporary migration. As an accompanying effect, the magnitude of remittances sent from migrants to their home country changed. According to the WorldBank (2010), Germany experiences an outflow of remittances worth 15 trillion or 2.4 times the amount of outflow observed in 1990. Size and destination of remittances flows, therefore, may influence the economy of sending and receiving countries. From a sending country perspective, remittances not only reduce domestic consumption and savings, they also are affecting the demand of export goods through the real exchange rate channel and factor input through the labor supply channel. Using a computable general-equilibrium-model with heterogeneous altruistic migrant households, we quantify the effects of remittances on the macroeconomy recognizing three channels, the exchange rate, the consumption-savings and the labor supply channel.

The amount of remittances sent by migrant households relies on individual characteristics like income, employment status, partnership and the duration of stay. Migrants planning to stay only temporarily in the host country tend to remit more money to their relatives back home than migrants with a permanent migration plan. Using the German Socio-Economic Panel Study (SOEP), a unique data set that concerns individual characteristics as well as earning and spending of household members in Germany, we estimate remittances as a function of migrants' characteristics. Based on these estimates, we calibrate altruism coefficients for different groups of migrants and simulate the effect of remittances on the macroeconomy using the general equilibrium model developed in this paper. We show that the migrants intended duration of stay, indeed, affects crucial macroeconomic variables like the trade balance, private consumption and production.

Considering these results, the paper contributes to the existing literature on migration and remittances in at least three ways. First, we estimate the amounts of remittances sent by migrant households according to individual and partner characteristics. Second, we build a theoretical general-equilibrium model, which explains the amount of remittances sent by migrants to their relatives out of a utility maximization framework. To all of our knowledge, a theoretical model combining endogenously determined remittances of heterogeneous households with a multisectoral trade framework containing intermediate goods and trade is a novel approach in the economic literature on migration and remittances. Third, we apply the theoretical model to the German data and are able to simulate the impact of migration flows on the German economy. We can show,

[3] 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 them. Bulgaria and Romania joined the EU on January 1st, 2007.

that migrants' behavior impacts crucial macroeconomic variables. Temporary migrants more often send money back home and may consume goods there, whereas migrants with permanent migration plans send fewer remittances and consume more goods in the host country. These differences affect the real exchange rate between migrants' home and host country and change the sectoral structure of production by triggering an opposite Dutch disease effect[4]; the remittances sent by migrants to their home country tend to benefit the export sectors of the host country.

The remainder of this paper is organized as follows. The next section summarizes the literature regarding the macroeconomic implications of remittances. The "macroeconomic model" section provides a theoretical outline of the general equilibrium model that is used in this study, whereas the "estimation and numerical specification" section describes our empirical strategy, in addition to the calibration and simulation of the model. Finally, the last section concludes the paper.

2. Related literature

The literature on remittances has primarily focused on the microeconomic aspects of this issue. In these models, migration is usually treated as an informal familial arrangement, with benefits that constitute risk diversion and the intergenerational financing of investments (Rapoport and Docquier, 2005). Remittances are a key element of such a contract and combine different components, such as altruism, insurance, investment, inheritance, strategic considerations and exchange.

The main focus of empirical studies are labor supply effects of relatives receiving remittances. For Latin American economies, Fajnzylber and Lopez (2008), Funkhouser (1995) and Hanson (2007) report that remittances can reduce the household labor supply. In contrast, Yang (2008) shows that remittances can also promote entrepreneurial activities by relaxing liquidity constraints and, thus, increase the labor supply. A second strand of the empirical literature focuses on the amount of remittances sent by migrants. Dustmann and Mestres (2010) show, using the SOEP, that return plans are related to large changes in remittances flows. Using a small partial equilibrium model, Dustmann (2000) shows that migrants with a temporary migration plan invest less in specific human capital of the host country and tend to have higher costs of leisure than migrants with a permanent migration plan. Temporary migrants tend to work more and in the first years since their arrival, this could result in a higher amount of remittances sent home.

[4] A situation where a country exports natural resources and harms its export sector by the appreciation of the currency is called a dutch disease phenomenon. In this article migrants send remittances to their home country which depreciates the German currency and benefits its export sector. We call this phenomenon where a country sends transfers to another country and benefits from depreciation an opposite dutch disease effect.

Macroeconomic models on remittances remain scarce; however, several studies analyze the macroeconomic effects of remittances and the real exchange rate movements in general equilibrium models.[5] Following the macroeconometric literature on remittances and Dutch disease effects[6], Acosta et al. (2009) use a dynamic stochastic general equilibrium model to address these effects. In their model, the inflow of remittances results in an exchange rate appreciation leaving exports with a loss in international competitiveness, which, in turn, can reduce demand and production of domestic produced goods.

The general equilibrium model that is developed in the following chapter draws on several aspects of this literature. Remittances are endogenous in our model because of the utility optimization of heterogeneous households, wherein we integrate a microeconomic altruistic model, following Stark (1995), into a general equilibrium framework. This enables us to distinguish between different groups of migrants and to estimate altruism coefficients based on migrant's characteristics and the planned duration of stay. We use a multisector framework that calibrates openness on the basis of input-output tables from Eurostat. This method enables us to derive sector-specific effects and to take into account that in Germany, there is nearly no non-tradable sector. Furthermore, we can capture the complex relationships of international production chains and the demand for intermediate goods adding further insight into the appearance of Dutch-disease like effects. Finally, we include imperfect labor markets in our theoretical model to derive further insight into the labor market effects of remittances. To all of our knowledge this aspect is not covered in the literature on the macroeconomics of remittances, yet.

3. The Model

In this section, we build a model that includes remittances, imperfect labor markets and multiple regions.[7] This theoretical model is the basis for our simulation exercise, which is intended to capture the relationship between migration, remittances, the real exchange rate and the different sectors of the economy. These relationships are then used to explain the emergence of an opposite Dutch disease effect.

The rational behind the migration decision is as follows. A member of a household decides, with the agreement of the other household members, to migrate. The potential flows of remittances are considered in this decision. Accordingly, the utility of all household members, who remain in the home country

[5] An additional strand of literature uses IS-LM-BP like models and real business cycle models to analyze the implications of pro- and countercyclicity of remittances for stabilization policy (e.g. Durdu and Sayan, 2010; Vargas-Silva, 2008). In these studies remittances are usually treated as a positive or negative exogenous shock on aggregate demand.

[6] Amuedo-Dorantes and Pozo (2004); Bourdet and Falck (2006) analyze the effects of remittances in macroeconometric models.

[7] The description of the model follows a contribution of Löfgren et al. (2001) who set some conventions for CGE modeling and reporting.

or also migrated to other countries, is included in the migrant's utility function. An "altruism" coefficient weights the amount of utility that is generated through the consumption of the household members who stay in foreign countries.

Therefore, migration increases the labor supply in an imperfect labor market setting, resulting in wage pressure and unemployment. Remittances change the real exchange rate and lead to a change in production, depending on the openness of the sectors of the economy.

3.1. Households

The model economy consists of a large number of households with infinite lifespans, wherein a representative household seeks to maximize utility. We further assume that some members of the household live abroad (e.g., in a distant source country). The utility of these distant members 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 V of the migrant household and the utility function of the relatives back home V^* take the following form

$$V(.) = \beta V^*(.) + (1-\beta)U(.), \tag{1}$$

$$V^*(.) = \beta^* V(.) + (1-\beta^*)U^*(.). \tag{2}$$

A household derives utility $U(.)$ through the migrant's consumption of goods Q_c and the utility of the relatives abroad $V^*(Q_c^*, \gamma_c^*)$. The parameter β can be interpreted as the altruism coefficient and γ_c, γ_c^* denote a subsistence level of consumption either of the migrant or of the relatives.

The utility function of the members of the household who stay in a foreign country evolves analogously. The two equations 1 and 2 are solved for $V(.)$ with

$$V\left(Q_c, Q_c^*, \gamma_c, \gamma_c^*\right) = (1-\alpha)\, U\left(Q_c, \gamma_c\right) + \alpha U^*\left(Q_c^*, \gamma_c^*\right). \tag{3}$$

Where $\alpha = \frac{\beta(1-\beta^*)}{1-\beta^*\beta}$ and $0 \leq \alpha \leq \frac{1}{2}$. The migrant's utility function is rewritten as an indirect utility function.

$$V^*\left(Q_c, Q_c^*, \gamma_c, \gamma_c^*\right) = (1-\alpha)\, U\left(Y-T\right) + \alpha U^*\left(Y^*+T\right) \tag{4}$$

Maximizing the migrant's utility function for optimal remittances assuming that relatives don't send transfers, T, yields.

$$-(1-\alpha)\frac{\partial U}{\partial Q_c} + \alpha \frac{\partial U^*}{\partial Q_c^*} \leq 0 \tag{5}$$

Now, we use the inverse consumption function $V(I)$. Because the migrant and his or her relatives have similar preferences by assumption, optimal remittances can be expressed in terms of disposable income Y.

$$\bar{T} = \alpha Y - (1-\alpha)\, Y^* \tag{6}$$

Consumers' preferences are specified by a Stone-Geary function. The household only derives utility from a part of total consumption Q_c, which exceeds the subsistence level of consumption γ_c. Utility maximization is subject to the disposable income and the budget constraint of the household. The parameter α_c denotes consumers preferences and p_c the price of commodity c.

$$\max_{Q_c,\gamma_c} U(Q_c,\gamma_c) = \prod_{c=1}^{n}(Q_c-\gamma_c)^{\alpha_c} \tag{7}$$

s.t.

$$(1-t_Y-s)\,Y - T \leq \sum_{c=1}^{n}(1+t_{Qc})p_cQ_c$$

with $Q_c > \gamma_c \geq 0$ and $\sum_{c=1}^{n}\alpha_c = 1$ for $c = 1, 2, ...n$ and

$$Y = \left(\sum_{j=1}^{n}(1-t_{Kj})i_jK_j + \sum_{j=1}^{n}(1-t_{Lj})w_jL_j + b\cdot w\cdot\left(N-\sum_{j=1}^{n}L_j\right)\right).$$

The household earns a return i_j via renting varieties j of capital K_j and wage w_j in exchange for supplying varieties j of labor L_j to the firm sector. Both sources of income are subject to specific capital t_{Kj} or labor-related taxes t_{Lj}. Because of imperfect labor markets, it is likely that the labor supply N exceeds the quantity of labor that is employed in the different sectors of the economy. The household receives unemployment benefits which are a fraction of average income w for unemployed labor. The variable b denotes the corresponding replacement rate. The available income for consumption spending I is defined as the household income Y net of income taxes t_YY, savings sY and remittances T. The parameter t_{Qc} denotes commodity specific taxes.

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 obtain the expenditures on each commodity. The parameter α_c can be taken as the marginal budget shares.

$$(1+t_{Qc})p_{Qc}Q_c = (1+t_{Qc})p_{Qc}\gamma_c + \alpha_c\left(I - \sum_{c=1}^{n}(1+t_{Qc})p_{Qc}\gamma_c\right) \tag{8}$$

The expenditure on each commodity can be divided into two parts. The first part is the minimum required quantity 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 the exponents is equal to one. Deriving the income elasticity of commodity c is straightforward.

$$\xi(Q_c, I_H) = \frac{\partial Q_c}{\partial I}\cdot\frac{I}{Q_c} = \frac{\alpha_cI}{(1+t_{Qc})p_{Qc}Q_c} \tag{9}$$

Following Saito (2004), we derive a Frisch parameter ϕ from the demand relationship of the commodities to capture the average elasticity of substitution. Therefore, we solve the Lagrange function for the Lagrangian λ and calculate the expenditure elasticity of the marginal utility of expenditure, which is the Frisch parameter. This elasticity can be used to calibrate γ_c, which is the minimum required quantity of a good that the representative household requires.

$$\phi = \frac{d\lambda}{dI} \cdot \frac{I}{\lambda} = -\frac{I}{(I - \sum_{i=1}^{n} p_{Qc}\gamma_c)} \tag{10}$$

3.2. Firms

Both final and intermediate goods are supplied in competitive domestic markets. Factor demands are also determined in a perfectly competitive fashion. A representative firm of an activity a solves a cost minimization problem to determine the factor demand that is subject to a nested linear-homogeneous CES production function. In the first nest, each firm combines the gross value added V_a and intermediate goods I_a to produce the gross output Q_{Da}. Depending on the production structure of the economy, gross output can be divided into different goods $Q_{Da}\phi_{ca} = Q_{Dc}$, with ϕ_{ac} as share parameter. The parameters p_{Va} and p_{Ia} denote the internal price of value added and the price for intermediate goods, respectively.

$$\min_{V_a, I_a} \Gamma_{Q_{Da}}(V_a, I_a) = p_{Va}V_a + p_{Ia}I_a \tag{11}$$

s.t.

$$Q_{Da} = (\mu_a V_a^{-\rho_a} + (1 - \mu_a)I_a^{-\rho_a})^{\frac{-1}{\rho_a}}$$

Value added is generated by using capital K and labor L in the second nest of the production function. The parameter ρ denotes the elasticity of substitution among the different factors, A denotes factor productivity, and μ can be taken as a share parameter of production. The corresponding parameters $\rho_V, \rho_{La,}, \rho_{Ka}$ and $\mu_{Va}, \mu_{La}, \mu_{Ka}$ exist in each nest of the production function.

The factors of production are rewarded with the aggregate interest rate r on capital and the aggregate wage w on labor. The firm minimizes its total costs Γ in every nest of the production function.

$$\min_{K_a, L_a} \Gamma_{Va}(K_a, L_a) = r_a K_a + w_a L_a \tag{12}$$

s.t.

$$V_a = A_a \mu_{Va} \left(\mu_{Va} K_a^{-\rho_{Va}} + (1 - \mu_{Va})L_a^{-\rho_{Va}}\right)^{\frac{-1}{\rho_{Va}}}$$

Finally, in the third nest, the firm minimizes the two cost functions $\Gamma_{Laj}, \Gamma_{Kaj}$ with regard to two production functions, which aggregate the varieties of capital and labor.

$$\min_{L_{aj}} \Gamma_{Laj}\left(L_{aj}\right) = \sum_{j=1}^{n} w_{aj} L_{aj} \quad \min_{K_{aj}} \Gamma_{Kaj}\left(K_{aj}\right) = \sum_{j=1}^{n} \quad r_{aj} \quad K_{aj} \tag{13}$$

s.t.

$$L_a = \left(\sum_{j=1}^{n} \mu_{Laj} L_{aj}^{-\rho_{Lj}}\right)^{\frac{-1}{\rho_{Lj}}} \quad K_a = \left(\sum_{j=1}^{n} \mu_{Kaj} K_{aj}^{-\rho_{Kj}}\right)^{\frac{-1}{\rho_{Kj}}}$$

Using the total rent of capital and the total wage rate, we obtain the demand functions of every variety of the production factors of labor L_{aj} and capital K_{aj} according to their specific compensations r_{aj} and w_{aj}, respectively. After solving the minimization problem in each nest, we can derive the demand for each variety of capital and labor and the demand for intermediate goods. A capital and labor packer aggregates the sectoral demands $K_{aj} = \left(\frac{r_{aj}}{r_a}\right)^{\rho_{Kaj}} K_a$ and $L_{aj} = \left(\frac{w_{aj}}{w_a}\right)^{\rho_{Laj}} L_a$.

$$K_a = \mu_{Va} \left(\frac{r_a}{p_{Va}}\right)^{\rho_{Va}} \mu_j \left(\frac{p_{Va}}{p_a}\right)^{\rho_a} Q_{Da}, \tag{14}$$

$$L_a = (1 - \mu V_a) \left(\frac{w_a}{p_{Va}}\right)^{\rho_{Va}} \mu_a \left(\frac{p_{Va}}{p_a}\right)^{\rho_a} Q_{Da} \tag{15}$$

$$I_a = (1 - \mu_a) \left(\frac{p_{Ia}}{p_a}\right)^{\rho_a} Q_{Da} \tag{16}$$

3.3. World economy

It is generally assumed that exporters and importers in the economy do not influence world prices p_{fc}. Import prices p_{Mfc} and export prices p_{Efc} are measured in local currency. Tariffs and non-tariff trade barriers on either imports t_{Mfc} that are charged by the home country or on exports t_{Efc} that are charged by a foreign country f, increase import prices and decrease export prices. The model accounts for country specific exchange rates regimes with x_f denoting the exchange rate.

$$p_{Mfc} = (1 + t_{Mfc})\, x_f p_{fc} \tag{17}$$

$$p_{Efc} = (1 - t_{Efc})\, x_f p_{fc} \tag{18}$$

3.3.1. Export sector

The firm has a choice between selling a given amount of its product in the home market Q_{DDc} or to export it E_c to foreign countries f that may be inside or outside of the EU. A firm maximizes its revenues based on a CET transformation function considering the prices of goods for export p_{Ec} and for domestic sales p_{Dc}. The parameter ρ indicates the elasticity of the transformation, whereas the parameter γ can be seen as the share parameter of the CET function. The parameter a_{wc} accounts for different levels of technology.

$$\max_{E_c, Q_{DDc}} \Gamma_{Qc}\left(E_c, Q_{DDc}\right) = p_{Ec}E_c + p_{Dc}Q_{DDc} \tag{19}$$

$$Q_{Dc} = a_{Dc}\left[\gamma_{Tc}E_c^{-\rho_{Dc}} + \left(1-\gamma_{Tc}\right)Q_{DDc}^{-\rho_{Dc}}\right]^{-\frac{1}{1-\rho_{Dc}}} \tag{20}$$

We can determine the destination of exports by maximizing the revenue function based on a sub-CET function. The firm receives revenues from selling goods E_{fc} to different countries recognizing the corresponding export prices p_{Efc}. The parameter γ_{Wc} is a shift parameter, whereas ρ_{Wc} accounts for the substitution elasticity of different destinations within the sub-CET function.

$$\max_{E_{fc}} \Gamma_{Efc}\left(E_{fc}\right) = \sum_{f=1}^{o} p_{Efc}E_{fc} \tag{21}$$

$$E_c = a_{Wc}\left(\sum_{f=1}^{o} \gamma_{Wc}E_{fc}^{-\rho_{Wc}}\right)^{\frac{1}{1-\rho_{Wc}}} \tag{22}$$

After setting up the Lagrangian and the re-parameterization of $\rho_{Dc} = (1/\sigma_{Dci}) - 1$, we can derive the optimum supply for the home Q_{DDc} and the world markets E_c.

$$Q_{DDc} = \left(1-\gamma_{Dc}\right)^{\sigma_{Tc}} p_{Dc}^{-\sigma_{Tc}}\left[\gamma_{Tc}^{\sigma_{Tc}} p_{Ec}^{1-\sigma_{Tc}} + \left(1-\gamma_{Tc}\right)^{\sigma_{Tc}} p_{Dc}^{1-\sigma T_c}\right]^{\frac{\sigma_{Dc}}{1-\sigma_{Dc}}} Q_{Dc}/a_{Dc} \tag{23}$$

$$E_c = \gamma_{Dc}^{\sigma D_c} p_c^{E-\sigma D_c}\left[\gamma_{Dc}^{\sigma_{Dc}} pEc + \left(1-\gamma_{Dc}\right)^{\sigma_{Dc}} p_{Dc}^{1-\sigma_{Dc}}\right]^{\frac{\sigma_{Dc}}{1-\sigma_{Dc}}} Q_{Dc}/a_{Dc} \tag{24}$$

3.3.2. Import sector

A wholesaler minimizes the costs of the intermediate and final goods by combining different sources of goods with an Armington function Γ_{Mc}. 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_c with price p_{Mc} and domestically produced goods Q_{DDc} with price p_{Dc}. The

parameter γ_{Ac} is the shift parameter of the Armington function, and ρ_{Ac} is the elasticity of substituting goods from different source countries.

$$\min_{M_c, Q_{DDc}} \Gamma_{Mc}\left(M_c, Q_{DDc}\right) = p_{Mc} M_c + p_{Dc} Q_{DDc} \tag{25}$$

s.t.

$$Q_c = a_{Ac}\left[\gamma_{Ac} M_c^{-\rho_{Ac}} + \left(1-\gamma_{Ac}\right) Q_{DDc}^{-\rho_{Ac}}\right]^{\frac{1}{1-\rho_{Ac}}} \tag{26}$$

In the second nest of the Armington function Γ_{Mfc}, the wholesaler minimizes its costs by choosing the optimum combination of the different commodities M_{fc} with the price p_{Mfc} from different countries. The parameter γ_{Sc} is a shift parameter, and ρ_{Sfc} is the elasticity of substituting import goods from different source countries. The parameter a_{Sc} denotes the different levels of technology in the different sectors.

$$\min_{M_{fc}} \Gamma_{Mfc}\left(M_{fc}\right) = \sum_{f=1}^{o} p_{Mfc} M_{fc} \tag{27}$$

s.t.

$$M_c = a_{Sc}\left(\sum_{f=1}^{o} \gamma_{Sc} M_{fc}^{-\rho_{Sfc}}\right)^{\frac{1}{1-\rho_{Sfc}}} \tag{28}$$

We can, thus, derive the demand for imports and domestic production in the home market.

$$Q_{Dc} = \left(1-\gamma_{Tc}\right)^{\sigma_{Ac}} p_{Dc}^{-\sigma_{Ac}}\left[\gamma_{Ac}^{\sigma_{Ac}} p_{Mc}^{1-\sigma_{Ac}} + \left(1-\gamma_{Ac}\right)^{\sigma_{Ac}} p_{Dc}^{1-\sigma_{Ac}}\right]^{\frac{\sigma_{Ac}}{1-\sigma_{Ac}}} Q_c / a_{Ac} \tag{29}$$

$$M_c = \gamma_{Ac}^{\sigma_{Ac}} p_{Mc}^{-\sigma_{Ac}}\left[\gamma_{Ac}^{\sigma_{Ac}} p_{Mc}^{1-\sigma_{Ac}} + \left(1-\gamma_{Ac}\right)^{\sigma_{Ac}} p_{Dc}^{1-\sigma_{Ac}}\right]^{\frac{\sigma_{Ac}}{1-\sigma_{Ac}}} Q_c / a_{Ac} \tag{30}$$

The demand for imported goods from different countries is subject to a sub-Armington function, which yields the demand for imported goods according to different sources:

$$M_{fc} = \gamma_{Sc}^{\sigma_{Sc}} p_{fc}^{-\sigma_{Sc}}\left(\sum_{f=1}^{o} \gamma_{Sc}^{\sigma_{Sc}} p_{fc}^{-\sigma_{Sc}}\right)^{\frac{\sigma_{Sc}}{1-\sigma_{Sc}}} M_c / a_{Sc} \tag{31}$$

3.4. Government

The government levies taxes on labor[8] and capital usage, income and consumption. Additionally, it collects tariffs. Consequently, the government revenue function Y_G takes the following form:

[8] Please note that we assign public social security services to the state sector. Social security contributions are therefore treated as taxes and insurance payments as transfers.

$$Y_G = \sum_{c=1}^{n} \left(t_{Qc} Q_c p_{Dc} + \sum_{f=1}^{o} t_{Mfc} x_f p_{fc} M_{fc} \right) + \sum_{a=1}^{n} \sum_{j=1}^{n} \left(t_{Kj} K_{aj} r_{aj} + t_{Lj} L_{aj} w_{aj} \right). \tag{32}$$

The government spends its income on consumption Q_{Gc}, government savings S_G, sector related subsidies to firms and households Z_a, and unemployment benefits.

$$Y_G = (w \cdot b) \left(N - \sum_{j=1}^{n} L_j \right) + \sum_{a=1}^{n} p_a Z_a + \sum_{c=1}^{n} p_c Q_{Gc} + S_G \tag{33}$$

With respect to consumption, the government maximizes a Stone-Geary utility function that is subject to a budget constraint, which is derived from 32 and 33.

$$\max_{C_{Gc}, \gamma_{Gc}} U_G = \prod_c (Q_{Gc} - \gamma_{Gc})^{\alpha_{Gc}} \tag{34}$$

We can derive government expenditures for consumption using a method that is similar to that used for the household sector. We assume that the state sector is not subject to VAT payments. The consumption of the government is split into subsistence consumption γ_{Gc} and consumption for utility $\alpha_{Gc} Q_{Gc}$.

$$p_c Q_{Gc} = p_c \gamma_{Gc} + \alpha_{Gc} p_c Q_{Gc} \tag{35}$$

In addition to consumption and transfers, the state sector, like the firm sector, produces public goods using intermediate goods I_{Ga}, labor L_{Ga} and capital K_{Ga}. The state sector minimizes costs Γ_{QGa} using a CES production function Q_{Ga}.

$$\min_{V_{Ga}, I_{Ga}} \Gamma_{QGa} (V_{Ga}, I_{Ga}) = p_{GVa} V_{Ga} + p_{Ia} I_{Ga} \tag{36}$$

s.t.

$$Q_{Ga} = (\mu_{Ga} V_{Ga}^{-\rho_{Ga}} + (1 - \mu_{Ga}) I_{Ga}^{-\rho_{Ga}})^{\frac{-1}{\rho_{Ga}}} \tag{37}$$

We can then derive the demand for these three kinds of inputs. We assume that the state sector chooses inputs in terms of varieties of labor and capital in a way that is similar to private companies; however, the state does not export goods but, instead, buys aggregate intermediate goods from wholesalers.

$$K_{Gaj} = \mu_{GVa} \left(\frac{r_{aj}}{r_a} \right)^{\rho_{GKaj}} \left(\frac{r_a}{p_{Va}} \right)^{\rho_{GVa}} \mu_{GVa} \left(\frac{p_{Va}}{p_a} \right)^{\rho_{Ga}} Q_{Ga} \tag{38}$$

$$L_{Ga} = (1 - \mu_{GVa}) \left(\frac{w_a}{p_{Va}} \right)^{\rho_{GVa}} \mu_{GVa} \left(\frac{p_{Va}}{p_a} \right)^{\rho_{Ga}} Q_{Ga} \tag{39}$$

$$I_{Ga} = (1 - \mu_{Ga}) \left(\frac{p_{Ia}}{p_a} \right)^{\rho_{Ga}} Q_{Ga} \tag{40}$$

3.5. Equilibrium conditions

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

$$p_c Q_{Gc} + (1 + t_{Qc})\, p_c Q_c + p_c\, (I_c + I_{Gc}) = p_{Dc} Q_{DDc} + \sum_{f=1}^{o} (p_{Mfc} M_{fc}) - \sum_{f=1}^{o} (p_{Efc} E_{fc}) \tag{41}$$

The capital markets are in equilibrium if supply K_S equals demand and if the labor markets are subject to a wage-setting curve $\hbar$ and, therefore, are in disequilibrium. The firms take the bargained wages as a given and adjust their labor demand.

$$\sum_{j=1}^{n} (K_j + K_{Gj}) = K_S \tag{42}$$

$$w = \hbar \left(N - \sum_{a=1}^{n} \sum_{j=1}^{n} (L_{aj} + L_{Gj}) \right) \tag{43}$$

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

$$\sum_{f=1}^{o} \sum_{c=1}^{n} p_{Mfc} M_{fc} = \sum_{f=1}^{o} \sum_{c=1}^{n} p_{Efc} E_{fc} + \sum_{f=1}^{o} S_f \tag{44}$$

4. Estimation and numerical specification

The general equilibrium problem that was described in our theoretical model features characteristics that can be formulated as mixed complementarity problem (MCP). Using this formulation we are able to apply the model to the data for simulation purposes. The calibration of the model is done using most recent input-output matrices from Eurostat, which provide data on the German economy in 2007. The altruism coefficient, however, is calibrated on basis of our estimates on the remittance behavior of migrants in Germany. We use the SOEP to estimate remittances according to migrants' individual characteristics and family relations.

4.1. Data and Estimation

To address the remittance behaviors of migrants in Germany, we use the 1996 to 2009 waves of the SOEP. The SOEP is a representative and longitudinal survey of private households that was started in 1984 in West Germany (Wagner et al., 2007). The data have been updated several times, and one of the largest updates took place in 1998. 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. The SOEP is a unique data set because of its oversampling of migrants. From the start of the SOEP study, households with foreign-born household heads exceeded the proportion of migrants in the German population. This feature of the SOEP allows for detailed investigations of migrants' behaviors and their remittances to their family members. To address migrants with ties in their home countries and not Germans with foreign nationalities, we restricted our sample and only selected first generation, foreign-born migrants. We included naturalized migrants and excluded persons with a foreign nationality who were born in Germany. Additionally, we used an unbalanced sample, which includes individuals who entered the sample after 1996 and subjects who were absent from one or more waves. Because immigrants are highly mobile and may perform circular migration, this setting might have helped to reduce selection bias in the study.

4.1.1. Empirical specification

The SOEP includes a variety of variables that measure the migration plans of migrants who reside in Germany. Migrants are questioned about their estimated durations of stay, and, from 1996 onwards, a second question was added to measure respondents' intentions to "remain in Germany permanently" [9]. Moreover, the SOEP measures migrants' intentions to remit and the share of remittances that are provided to relatives in the home country.[10] Every year, migrants are asked to give detailed information about financial support to relatives or other persons who are outside of their households. This question distinguishes between payments to parents/parents-in-law, children/children-in-law, spouse (separated or divorced), other relatives and unrelated persons. The respondents were asked to specify if the recipients live in Germany or in a foreign country. We included various kinds of payments to persons who were living outside of Germany in the questionnaire to construct a dummy variable. Therein, the value one was selected for remittances to a foreign country and zero otherwise. A second variable

[9] Using this question it is no longer necessary to include an artificial threshold to distinguish permanent and temporary migration.

[10] We assume that migrants remit money to their country of origin because it is likely that the migrant's parents or other family members, which receive the money are living in the migrant's country of origin, but we cannot prove this assumption based on the SOEP data, as the data has only the question, whether the person, which receives the money lives abroad, but not if this is the migrant's country of origin.

measures the exact amount of the remitted money. Here, we use the logarithm of the remittance amounts in Euro [11]. To measure the migrants' individual characteristics and their ability to send money home, we used information regarding the age of the individual at the time of immigration, years since migration, years of education, nationality, income, gender and marital and employment status. We also included information on the number of children who were under the age of 16 and were living in the host country household. In addition to the migrant's characteristics, we included the characteristics of the migrant's partner, regardless of his or her migrational background. This approach allows us to draw a more complete picture of the household. Specifically, we used information on the partner's income, years of education, nationality and desire to permanently remain in Germany.

Following Dustmann and Mestres (2010), we estimate the impact of these characteristics on the probability of remitting and the remitted amounts using simple probit and OLS models. As Dustmann (2000) has demonstrated, conventional fixed effect models and forward orthogonal fixed effects regressions (Arellano and Carrasco, 2003) might be biased. Our regressions are of the following type:

$$Y_{it} = \beta_0 + \beta_1 * temp + \beta_2 * par + \beta_3 * X_{it} + u_{it} \tag{45}$$

$$Y_{it} = \beta_0 + \beta_1 * temp + \beta_2 * par + \beta_3 * X_{it} + \beta_4 * partemp_{it} + \beta_5 * Z_{it} + u_{it} \tag{46}$$

Y measures either the probability that a person i will remit money to his or her country of origin over time t or the amount remitted. The first specification of our model described in equation eq:Estimation equation probit takes only individual characteristics into account, while the second specification estimates the probability and the amount of money a person remits based on individual as well as on the partner's characteristics . The variable "temporary" is one of our primary variables of interest, and it is specified as a dummy variable that takes the value one if an individual intends to return to his or her home country and zero otherwise. Using this dummy variable, we can measure the impact of migrants' intentions to return to their country of origin on the probability of them remitting and the remittance amounts. The second dummy variable, which is specified in our equation as partner, indicates the presence of a partner in the migrant household in the host country. We do not distinguish between marriage and cohabitation. Other individual characteristics, such as education or income, are covered by the parameter X.

In a second specification (see equation 46), we included the partner's characteristics in the evaluations of individuals who live with partners, as shown in the formula for the intention of the partner to stay in Germany temporarily (partemp). These data are included as an interaction term with the partner

[11] The dependent variable takes the following structure: log(remittances in Euro + 1).

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's characteristics on the probability of remitting and the remitted amounts. Additional partner characteristics enter the equations by the parameter Z.

4.1.2. Descriptive evidence

Table 1 provides descriptive information on the percentage of individuals who remit, the amount of money they remit, their monthly earnings and, finally, the percentage of migrants' annual incomes that are spent on remittances. The last variable is calculated using the migrants' average monthly incomes and the average amount of monthly remittances. At first glance, we can observe significant differences with regard to individual characteristics. Remittances seem to be a luxury good, and the probabilities of remitting and remittance amounts substantially differ between employed and unemployed migrants. Nearly 18 percent of the migrants who had full time jobs sent money to their home country, whereas only 6.5 percent of the migrants who were unemployed or otherwise sent money. Moreover, the remittance amounts were more than three times higher among the employed participants than among the unemployed participants.

Table 1 about here

Interestingly, financial factors are not the only attributes that influence the probability of remitting and the remitted amounts. Nationality and future plans regarding the duration of the stay seem to play an important role in remittances. A total of 15 percent of the migrants who intended to leave Germany sent money home compared with 12.5 percent of those who intended to permanently stay in Germany. The group differences are smaller when we compare migrants with foreign and German nationalities. A total of 12.5 percent of migrants who had foreign nationalities sent money home, whereas only 12 percent of migrants with German citizenship did so. We found similar results for migrants whose partners had foreign (12.5 percent) or German citizenship (12 percent). Furthermore, the amounts of money that were remitted by migrants with German or foreign citizenship (as well as for migrants with German or foreign partners) differed. Additionally, we observed differences between male and female migrants. Females reported a lower probability of remitting in comparison to their male counterparts. In addition, the men in the sample, on average, sent more money to their home country; however, when we measure remittances as a percentage of annual income, the picture changes, that is, the women sent a higher percentage of their annual income abroad. Overall, those migrants who intend to temporarily stay in Germany are not only more likely to send the largest amounts of money abroad, but they also send a higher percentage of their annual income. Temporary immigrants remit, on average, more than four percent of their annual income, whereas permanent migrants remit less than two percent of their income.

4.1.3. Estimation results

The descriptive statistics in Table 1 that were identified in this study indicate strong differences in migrants' remittance behaviors. To identify the likelihood of remitting and the amount of money remitted, we tested two model specifications using probit and OLS regressions so as to create four models. The specifications of these models differ with regard to the inclusion of specific characteristics that are related to the migrants' partners. Therefore, columns three and four in Table 2 include additional partner characteristics. This approach allows us to account for partners' influences on the probability of remitting and the remitted amounts. A partner may influence the decision to remit through different mechanisms. First, a partner's salary might substantially increase the household's income and, thus, the ability to remit. Second, the decision to return to the home country may be a household decision. Therefore, we include information on the partner's nationality, his or her migration plans regarding the duration of the stay in Germany, education and income.

Table 2 about here

In all of our models, the variable identifying a temporary stay in Germany shows a strong and positive effect on the probability of remitting and the remitted amounts. All of our models indicate that the age at migration positively impacts the likelihood to remit and the remittance amount. Persons who migrate at an older age might have stronger ties with their country of origin and are, therefore, more likely to remit and send larger amounts of money home. Moreover, the time that is spent in the host country also influences the probability of remitting and the remitted amounts. All Models demonstrate a clear concave relationship between the time spent in the host country and the probability of remitting and the remitted amounts. The probability of remitting and also the amount remitted increases in the first years after arriving in the host country according to our first two models. In Model 1, after 23 years of residence in the host country, the probability of sending money declines again (in Model 2, the remitted amount decreases after 20 years in the host country). Our regressions also indicate that like the migrant's future plans (temporary vs. permanently), the partner's migration plans significantly influence the probability of remitting and the remitted amounts. This result supports the correlation of migration plans with remittances that is depicted in Table 1. In Model 4, the remittance amount increases by 20 percent when migrants have a temporary migration plan and decreases as a function of the duration of stay by 1.5 percent per year.

In all of our models, education positively impacts the probability of remitting and the remitted amounts. More educated migrants might more effectively integrate into the new labor market e.g., they might know the language or be able to learn it quickly. Better workforce integration and better education result in higher wages. In turn, more educated migrants can afford to send larger

remittances. Finally, individual income has a positive and highly significant impact on both dependent variables. With every percent increase in the migrant's earnings, the amount of remittances increases by 0.09 percent and the likelihood to remit money increases by 0.07 percent. This finding confirms the Stark model's implication that sending money home depends on a migrant's income. Remittances can be interpreted as a kind of luxury good that shares increasing disposable income with other forms of consumption.[12]

A higher number of children in the host country reduces the amount of money that is sent and the likelihood of remitting. Although the effect is weaker in Models 3 and 4, which control for partner characteristics, individuals with children in their host countries are, on the one hand, more likely to have their immediate family with them and have, therefore, a lower altruism coefficient for their household members in their home country. On the other hand, children generally reduce per capita household income, which results in lower remittances.

Our inclusion of the variables that relate to the migrants' partners indicates that the partner's employment status positively influences the probability of remitting and the remitted amounts. Both Models 3 and 4 show that partners' migration plans are also important to remittance behaviors. Although the effect is weaker than the individual effect, it is stable and significant. Temporary migrants who live with a partner in Germany who himself or herself intends to return to his or her home country are 26 percent more likely to remit money and remit 36 percent more in comparison to a single migrant who intends to permanently live in the host country.

4.2. Simulation

We follow Böhringer et al. (2003) by specifying the general equilibrium in the CGE model as a mixed complementarity problem (MCP). According to Cottle et al. (2009) and Rutherford (1995), such a problem can be best solved using the PATH solver.[13]In the MCP approach, equilibrium conditions are formulated as weak inequalities and conditions of complementary slackness between variables and equilibrium conditions. The model was set up as an Arrow-Debreu economy with $n = 16$ commodities and $m = 16$ domestic industries. In total, there are 2 agricultural industries, 4 manufacturing industries and 10 service industries. Each commodity corresponds to an industry.

4.2.1. Calibration

The economic relationships in the macroeconomic model are calibrated using a symmetric social accounting matrix. The social accounting matrix builds on

[12]In our model we use a Stone-Geary utility function to reflect these empirical findings.

[13]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.

the input-output matrices that are provided by Eurostat in 2007. We took information on consumption by household type from the German microcensus of the same year and data on the replacement rate of different kinds of labor.

The SAM satisfied the model's microeconomic equilibrium conditions and was used to calibrate most of the model's parameters. Nevertheless, we could not calibrate the elasticity of substitution between capital and labor and the Armington elasticities. Thus, we used standard substitution elasticities and estimates of the Armington elasticities based on Saito (2004) [14]. We calibrated the altruism coefficients of households based on our econometric estimates from the SOEP data-set.

Additionally, we took the elasticities between the unemployment and wage rates from the empirical study of Brücker et al. (2009). The wage setting curve, which describes the bargaining of trade unions and employers, has an elasticity of -0.08 for Germany.

4.2.2. Scenarios

Ever since the 1950s, migration is a key driving force for population growth in Germany. The migration balance is positive in most years at a yearly amount of between 129.000 and 354.000 people. In the last five years, however, the migration balance was declining and not always positive. There are at least two reasons for this phenomenon. The net-outflow of people with a German citizenship is rising and the number of ethnic German immigrants from former socialist countries is falling. In the next years it is expected that the migration balance is rising again. Favorable economic conditions, open labor markets and an increasing demand in skilled workers should increase immigration in the next years. Emigration, on the other hand, should decrease. The nature of the aging process in Germany reduces the cohort of people most likely to leave the country. Taking these considerations into account, the Federal Statistical Office in Germany is expecting that migration in the next decade will be between 100.000 and 200.000 migrants after a short period of still moderate migration in the next few years.

Table 3 about here

Remittances, in all scenarios of our model, were calibrated on the basis of our empirical estimates. When we accounted for individual characteristics (e.g., age, years since migration and intention to stay), we derived the altruism coefficient and the remittance amounts sent home. Specifically, if new migrants are assumed to behave similarly to migrants who arrived in Germany in the years leading up to 2007, a yearly inflow of between 100.000 and 200.000 people in the next years would increase remittances by approximately 716 million to 1.4

[14] We used a variety of alternative substitution elasticities provided for sensitivity analysis.

billion Euro. Following migration projections of the Federal Statistical Office in Germany, we assume in scenarios of type A a net increase in migration of 900.000 people and in scenarios of type B an increase of 1.6 million people in the next decade (2012 to 2021). These projections tend to be a lower and an upper bound of migration towards Germany. Incoming migrants are expected to be young and to have a high labor market participation rate, which increases the labor supply in Germany by 1.4 or 2.2 percent. In scenario 1, we assume that migrants behave like host country citizens and send only small remittance amounts to foreign countries. In the following two scenarios, we change this assumption. In Scenario 3, we make the counterfactual assumption that all new arrivals are temporary migrants, whereas, in Scenario 2, we assume that all migrants intend to permanently stay in Germany.

4.2.3. Simulation results

The simulation results are essentially driven by two forces, first the increase in labor supply and second, the exchange rate effect of remittances. The labor supply and consumption effects of remittances are limited given the low remittances flows associated with a moderate inflow of migrants in the next decade.

In our model, migration increases production and lowers wages and because of imperfect labor markets, increases unemployment. Production factors are mobile between the different sectors of the economy; however, the transition from one occupation to another is subject to costs. These costs limit the redistribution of labor across the sectors of the economy. According to this framework, the most efficient use of additional labor changes the distribution of labor between tradable and non-tradable goods producing sectors.[15]

As a result of increased migration, the German economy will experience a strong increase in production of non-tradables (e.g., hotel, restaurant services and education). The distribution of additional migrant labor across the various sectors of the economy determines, to a large extent, the trade effects of migration. For the German economy, we can observe a strong increase in imports. Exports do also increase, but at a lower extend than imports. Tradable goods production (e.g., manufacturing) is affected by the increase in labor supply less than proportional, reflecting the fact that labor intensive non-tradable goods production is more affected by decreasing wages than the capital intensive tradable goods production. Imports of final goods increase because migrants increase the demand for private consumption. The inflow of additional labor decreases wages and should dampen final and intermediate good prices within the economy. In a one sector economy, this effect would trigger a depreciation of the real exchange rate while increasing exports. Since production in our multisectoral

[15] We have done several runs to check the sensitivity of the simulation with regard to the elasticities of substitution and the closure of the model. The model is rather stable with regard to the elasticity of substitution between production factors. The driving forces within the model are the factor market closure equations.

framework is increased basically in non-tradable goods sectors, effects on the real exchange rate are limited. By assumption, world prices are not affected by the increase in demand of consumption goods. However, the more than proportional increase in non-tradable goods production results in an appreciation of the real exchange rate and a worsening of the trade balance.

The outflow of remittances has a counter-directional effect on exchange rates and the trade balance. The outflow of financial flows affects the trade balance through the depreciation of the real exchange rate. The depreciation, given fixed world prices, accelerates foreign demand and increases production, especially in the manufacturing sector, which exports most of its products. The effect on private consumption is ambivalent and relies on the elasticity of foreign demand with respect to price changes of export goods. On the one hand, remittances reduce private consumption directly by re-channeling resources from private consumption to private remittances. On the other hand, private consumption increases because of lower unemployment and higher wages.

Table 4 and 5 about here

Table 4 and 5 report the percentage change of macroeconomic variables and tables 6 and 7 the percentage change of economic activities for the upper and lower bound of migration projections. The labor force increases in the lower bound of migration projections by 1.4 (table 4 and 6) and in the upper bound by 2.2 percent (table 5 and 7). In both of the two tables, we report three scenarios, where it is assumed that migrants behave like natives or have either a temporary or have a permanent migration plan. The migrant's plan influences the altruism of migrants with regard to relatives living abroad. If altruism is high, migrants tend to send more remittances. In the first scenario, where migrants act like natives, the additional labor force results in an increase in GDP by 0.55 percent. By assumption, the capital endowment remains constant .[16]Relative factor prices are changing because of the additional supply of labor. Wages are decreasing by 0.67 percent and the rate of return is increasing for capital by 0.7 percent. Because of the imperfect labor market setting, the unemployment rate is increasing by 0.37 percentage points.

Table 6 and 7 about here

The change in relative prices influences the production of economic activities within the economy. Activities with a high share of labor and a low share of

[16]In our sensitivity analysis, we relax this assumption. The trade effects remain rather unchanged, but, as capital is no restricting factor anymore, the increase in production is more pronounced in this kind of specification.

capital are increasing production by a bigger margin than activities with a low share of labor. Especially activities producing non-tradable goods, like the activity of household sector, can increase production by a more than proportional 0.9 percent.

The planned duration of stay increases GDP for both kinds of migration plans by 0.04 or 0.05 percent respectively compared to the first scenario where migrants send only small amounts of remittances like natives. The increase in GDP relies on a strong 0.16 (0.18) percent increase in intra-EU exports. The trade balance improves resulting in a higher production of activities producing tradable goods. The increase in manufacturing is strongest with 0.1 (0.12) percent, followed by a 0.02 (0.03) percent increase in construction which, in Germany, is strongly interrelated with the manufacturing sector. The activities producing non-tradable goods cannot increase production like the activities of households sector, or they lose like hotels and restaurant and public goods activities (e.g. public administration, health or social care and education).

As we have shown in our econometric estimates, temporary migrants do not only send more money home, they have also a higher probability to remit than their counterparts intending to stay permanently in the host country. This results in an additional 20 to 30 percent of remittances flows observed in the second scenario. In our simulations, the counterfactual assumption that all migrants have temporary migration plans results in an increase in intra-EU and extra-EU exports of 0.05 percent (approximately EUR 1.3 trillion) and extra-EU exports of 0.04 percent, GDP increases by an additional 0.01 percent and migrant households tend to reduce the demand for goods. Because of the real exchange rate appreciation, intra-EU imports increase only slightly (0.02 percent), and extra-EU imports, not affected by the exchange rate effect, increase by 0.05 percent. In sum, migrants with temporary migration plans slightly improve Germany's trade balance. The distribution of production in the different sectors of the economy tends to reflect the redistribution of production towards tradable goods. The manufacturing sector increases production by 0.03 percent, whereas most service sectors keep production constant. In sum, remittances tend to benefit the tradable goods sectors by a depreciation of the real exchange rate triggering an effect similar to the well known Dutch disease phenomenon. In this case, the sending country of remittances is able to benefit from a real exchange rate effect leaving the export industry better off.

5. Conclusions

In the next decade, migration to Germany is likely to increase because of an aging society and more prosperous economic conditions. Like in the UK, concerns about increasing remittances trigger fears that migration would harm the domestic economy. Among host country citizens, the outflow of remittances is often seen as an outflow of purchasing power; however, as we have shown in our simulation study, remittances are likely to benefit the German economy. An increase in remittances results in a higher share of exports, an improvement of the trade balance and an increase in GDP. For the service sectors, remittances

are less favorable. The shift in migrants' consumption towards remittances reduces demand of service goods from the host country.

As our calculations demonstrate, 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 in comparison to permanent migrants. We established three different scenarios to investigate these differences. In the first two scenarios, migrants either had temporary or permanent migration plans, whereas in the third scenario, migrants only sent a small amount of remittances, as is done by the German native population. At a first glance, the macroeconomic effects of changing from one counterfactual to another seem narrow. When we move from the temporary scenario to the permanent scenario, the simulation results show an increase in exports of 0.05 percent and an increase in GDP of 0.01 percent, only. Nevertheless, the remittances in this model are worth 380 billion Euro for a ten years period. Given the small scale of these remittances, the effects of our simulation are considerable. An open economy like Germany's seems to benefit from an opposite Dutch disease effect, in which the competitiveness of the tradable goods sectors increase.

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Table 1: Household characteristics and remittances.

		Remittances		
	Monthly income	Percentage of migrants	Annual amount	Percentage of income
Temporary migration plan	1139.13	15.48	517.93	4.11
	(17.38)	(0.66)	(26.91)	(0.48)
Permanent migration plan	1059.13	12.50	222.40	1.73
	(10.08)	(0.25)	(8.19)	(0.08)
Employed (full-time)	2372.93	17.64	454.17	1.75
	(11.58)	(0.34)	(16.50)	(0.67)
Unemployed	195.92	6.50	125.34	3.44
	(3.53)	(0.16)	(6.74)	(0.46)
Female	633.62	9.12	171.66	2.54
	(7.91)	(0.21)	(7.32)	(0.17)
Male	1548.26	11.47	304.12	1.94
	(13.23)	(0.24)	(12.51)	(0.19)
Foreign nationality	1087.75	12.57	373.74	3.09
	(10.82)	(0.25)	(13.68)	(0.23)
German nationality	1075.56	12.07	165.82	1.06
	(12.17)	(0.28)	(8.37)	(0.08)
Single	841.02	7.54	171.84	1.41
	(15.30)	(0.34)	(15.49)	(0.17)
Lives with a partner	1144.24	10.84	249.98	2.37
	(9.34)	(0.18)	(8.07)	(0.16)
Partner has a foreign nationality	1058.53	12.54	376.83	3.15
	(12.84)	(0.25)	(16.24)	(0.31)
Partner has a German nationality	1090.06	11.97	218.35	1.60
	(10.64)	(0.31)	(9.72)	(0.09)

Standard errors are in parentheses.

Table 2: Estimation results.

	(1)	(2)	(3)	(4)
	Transfers	Amount	Transfer	Amount
Individual characteristics				
Age at migration	0.011***	0.011***	0.013***	0.014***
	(0.001)	(0.001)	(0.001)	(0.002)
Years since migration	0.121*	0.128*	0.142**	0.151+
	(0.050)	(0.058)	(0.050)	(0.091)
Years since migration (square)	-0.003*	-0.003*	-0.003*	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)
Temporary migration plan	0.226***	0.301***	0.173***	0.204***
	(0.027)	(0.038)	(0.037)	(0.066)
Female	-0.074**	-0.132***	-0.145*	-0.241***
	(0.024)	(0.031)	(0.025)	(0.063)
Years of education	0.055***	0.070***	0.046***	0.054***
	(0.005)	(0.007)	(0.006)	(0.014)
Foreign nationality	-0.078**	-0.033	-0.043	0.042
	(0.030)	(0.039)	(0.041)	(0.076)
Individual income	0.074***	0.091***	0.072***	0.091***
	(0.004)	(0.011)	(0.004)	(0.015)
Lives with a partner in Germany	0.264***	-0.335***	-0.126	-0.342
	(0.032)	(0.037)	(0.088)	(0.213)
Number of children in host country	-0.050***	-0.083***	-0.038***	-0.073***
	(0.011)	(0.013)	(0.011)	(0.020)
Partner's characteristics				
Temporary migration plan			0.087*	0.158*
			(0.042)	(0.078)
Foreign nationality			-0.033	0.024
			(0.047)	(0.098)
Years of education			0.021**	0.037*
			(0.007)	(0.018)
Income			0.034***	0.052***
			(0.004)	(0.009)
Cases	21559	21559	21559	21559
R Square/ Pseudo R Square	0.089	0.061	0.094	0.067
Log likelihood	-7417.4		-7366.7	

Robust standard errors are used; year dummies are included; + p< 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 3: Net migration (2011-2020).

	Scenario A	Scenario B
2000	-46800	
2001	21828	
2002	16964	
2003	-792	
2004	-53840	
2005	38711	
2006	-4809	
2007	-6102	
2008	-17282	
2009	-32842	
2010	58845	
	Forecast	
2011	40000	80000
2012	60000	100000
2013	80000	120000
2014	100000	140000
2015	100000	160000
2016	100000	160000
2017	100000	170000
2018	100000	180000
2019	100000	190000
2020	100000	200000
2021	100000	200000

Source: Federal Statistical Office 2011.

Table 4: Simulation results lower bound

	Scenario A-1	Scenario A-2	Scenario A-3
	Change in percent		
GDP	0.55	0.59	0.60
Private consumption	0.55	0.57	0.57
Government consumption	0.58	0.61	0.62
Tax	0.76	0.75	0.75
Investment	0.57	0.61	0.62
Exports EU	0.52	0.68	0.73
Exports RdW	0.58	0.73	0.78
Imports EU	0.68	0.76	0.78
Imports RdW	0.63	0.79	0.84
Trade balance Intra-EU	-0.01	0.42	0.55
Trade balance Extra-EU	0.07	0.08	0.08
	0.70	0.77	0.79
Wages	-0.67	-0.62	-0.61
Labor supply	1.40	1.40	1.40
	Change in percentage points		
Unemployment rate	0.34	0.31	0.31

Table 5: Simulation results upper bound

	Scenario B-1	Scenario B-2	Scenario B-3
	Change in percent		
GDP	0.86	0.93	0.95
Private consumption	0.86	0.89	0.89
Government consumption	0.91	0.95	0.97
Tax	1.20	1.18	1.17
Investment	0.90	0.96	0.98
Exports EU	0.81	1.07	1.14
Exports RdW	0.91	1.15	1.23
Imports EU	1.07	1.20	1.23
Imports RdW	0.98	1.25	1.33
Trade balance Intra-EU	-0.01	0.66	0.86
Trade balance Extra-EU	0.11	0.13	0.13
	1.10	1.20	1.24
Wages	-1.05	-0.97	-0.95
Labor supply	2.20	2.20	2.20
	Change in percentage points		
Unemployment rate	0.53	0.49	0.48

Table 6: Simulation results.

	Scenario A-1	Scenario A-2	Scenario A-3
	Percentage change		
Agriculture, hunting and forestry	0.31	0.26	0.25
Fishing	1.31	1.31	1.31
Mining and quarrying	0.65	0.51	0.47
Manufacturing	0.60	0.70	0.72
Electricity, gas and water supply	0.47	0.47	0.47
Construction	0.57	0.59	0.60
Wholesale and retail trade	0.59	0.61	0.62
Hotels and restaurants	0.61	0.58	0.57
Transport, storage and communication	0.52	0.46	0.44
Financial intermediation	0.55	0.51	0.50
Real estate, renting and business activities	0.44	0.42	0.42
Public administration and defence; compulsory social security	0.74	0.73	0.73
Education	0.74	0.73	0.73
Health and social work	0.72	0.71	0.71
Other community, social and personal service activities	0.55	0.55	0.54
Activities of households	0.90	0.90	0.90

Note: Households can change occupation but suffer a loss in reduced productivity.

Table 7: Simulation results.

	Scenario B-1	Scenario B-2	Scenario B-3
	Percentage change		
Agriculture, hunting and forestry	0.48	0.41	0.39
Fishing	2.06	2.05	2.04
Mining and quarrying	1.02	0.80	0.73
Manufacturing	0.94	1.09	1.14
Electricity, gas and water supply	0.74	0.74	0.74
Construction	0.90	0.93	0.94
Wholesale and retail trade	0.93	0.96	0.97
Hotels and restaurants	0.95	0.91	0.90
Transport, storage and communication	0.81	0.72	0.70
Financial intermediation	0.86	0.80	0.79
Real estate, renting and business activities	0.68	0.66	0.66
Public administration and defence; compulsory social security	1.16	1.15	1.14
Education	1.16	1.15	1.14
Health and social work	1.13	1.11	1.11
Other community, social and personal service activities	0.87	0.85	0.85
Activities of households	1.41	1.41	1.41

Note: Households can change occupation but suffer a loss in reduced productivity.