Skill Premium Divergence: The Roles of Trade, Capital and Demographics☆

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Abstract

We construct an applied general equilibrium model to account for the divergent patterns of the skill premium in the Baltic countries, a set of transition economies that joined the European Union in 2004. Our model incorporates demand and supply factors that can potentially affect relative wages: changes in the skill composition of the labor supply, movements in the terms of trade, and complementarity between skilled labor and equipment capital in production. We find that changes in demographics (characterized by an increase in relative skill supply) lead to a decline in the skill premium, while equipment capital deepening raises the relative demand for skilled labor and thus increases the skill premium. In addition, favorable terms of trade lead to reallocation of resources towards sectors in which the transition economies have comparative advantages, thus lowering the skill premium. When we simulate the specific changes observed in each Baltic economy, we find that our model can closely account for the diverging patterns of skill premia for the period between 1995 and 2008.

JEL classification: E16, E25, J24, J31

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☆Very preliminary and incomplete version. All errors remain our own.

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1. Introduction

Because of their implications on income inequality, the patterns of the skill premium (defined as the wage of skilled labor relative to that of unskilled labor) have received a considerable amount of attention in the Economics literature in the recent years. Indeed, a vast number of articles have been written on the topic, documenting and accounting for skill premium trends across developed and developing economies.

In this article, we focus on the skill premium trends in the Baltic countries: Estonia, Latvia and Lithuania. These countries are frequently grouped as a single bloc because of their comparable sizes, output growth, inflation rates and openness. In spite of these similarities, we identify a divergent evolution in their skill premia: in Latvia, the skill premium increased by around 16% between 1995 and 2008, whereas in Estonia and Lithuania, it declined by 20% and 13%, respectively, during the same period. These divergent patterns are even more puzzling since in 1995 the *absolute* levels of skill premia were quite similar in the three countries, ranging from 1.8 in Latvia to 1.9 in both Estonia and Lithuania. The goal of this paper is to understand the reasons behind the skill premium divergence in the Baltic countries.

Although the literature has identified a number of potential hypotheses, no unanimous consensus has yet been reached on what factors drive the movements of the skill premium. In our study, we find three stylized facts regarding capital stock accumulation, the composition of labor supply, and the changes in the terms of trade that may play a role in accounting for the diverging skill premia. First, while all three countries experienced large increases in their stocks of capital, we find that the growth rate of equipment capital (which is usually considered complementary to skilled labor) was the largest in Latvia, followed by Lithuania and Estonia. Second, we find that all three countries experienced changes in demographics characterized by persistent declines in the working-age population, as well as large increases in the stock of workers with tertiary education. The magnitude of skill composition change of the labor force was the largest in Lithuania and Estonia, and to a lesser degree in Latvia. Finally, while most of the aggregate figures in the Baltic countries' foreign sectors exhibit striking similarities, we find that Estonia and Lithuania experienced improving terms of trade, while Latvia faced worsening terms of trade over the period we study.

To account for the diverging patterns of skill premium across the Baltic countries, we construct an applied general equilibrium model. Taking into account the previously described stylized facts, our model incorporates skilled and unskilled households who make consumption and labor/leisure decisions. Our model also includes producers who combine domestic goods and imported goods using an Armington aggregator to produce goods which will be purchased by both domestic and foreign households. Finally, firms that produce the domestic component hires different types of capital (equipment and structures) and labor (skilled and unskilled) using a CES production technology. Our aggregate production function exhibits complementarity between equipment capital and skilled labor, as highlighted by Krusell et al. (2000), among others.

Using the optimality conditions, we can decompose the growth of skill premium into three elements: first, the relative growth rates of equipment capital and skilled labor are positively correlated with the skill premium; second, the relative growth rates of skilled labor and unskilled labor are negatively correlated with the skill premium; and finally, the Heckscher-Ohlin (H-O) mechanism where reductions in trade costs shift factors to reallocate towards a country's comparative advantage sectors, and thus raise the relative return to the factor that is more intensively used in those sectors. Thus our model allows us to explore the labor demand *and* labor supply implications on the wage and therefore the skill premium.

Using a variety of data obtained from the national statistics offices (including input-output matrices, household budget surveys and international trade statistics) our model is built and calibrated so that it matches the main features of each Baltic country in 1995, the initial year in the period we study. We then use our model to conduct numerical simulations that replicate the observed changes in the terms of trade, the increase in the stock of capital available in each economy, and the changes in the relative skill supplies. As a result, we are able to determine the impact of each one of these simulations on the skill premium of each Baltic nation. This in turn allows us assess the relative contribution of each factor and in the process, disentangle the skill premium divergence puzzle by identifying which hypothesis played a larger role in each country (and which were less relevant) during the period of our analysis.

From our quantitative experiments, we find that the divergence of skill premium in the Baltics is the result of forces that affect skill premium in opposite directions. More specifically, we find that the changes in demographics (through an increase in relative skill supply) leads to a decline in the skill premium, while capital deepening raises the relative demand for skilled labor and thus increases the skill premium. In addition, favorable terms of trade lead to reallocation of factors towards sectors in which the transition economies have comparative advantages. As the Baltic countries have a comparative advantage in unskilled-intensive sectors, this cross-sector reallocation will lower the skill premium. All in all, we find that in Estonia and Lithuania, the forces that lower skill premium dominate the force that raises it, whereas in Latvia the opposite takes place. Quantitatively, when we feed in all the exogenous forces into our simulation (called our "joint" simulation), our model predicts a decrease in skill premium by 23% and 30% in Estonia and Lithuania, respectively, and an increase in skill premium by 10% in Latvia.

We also assess the validity of the predictions generated by our model by running a series of sensitivity experiments on the values of a set of parameters that govern crucial elasticities of substitution. In particular, we test for different trade elasticities (both imports and exports) and find that the skill premium changes are similar to what we found under our joint benchmark simulation. Additionally, we find that varying degrees of capital-skill complementarity play a big role in the demand side of the skill premium changes. Finally, we find that our qualitative implications are robust when we vary the preference parameters that govern elasticities of substitution over consumption and leisure.

Our research lies at the intersection of vast bodies of the literature ranging from international trade to labor economics to macroeconomics, as each field studies the consequences on the relative wages from different perspectives. Our contribution is to combine a variety of hypotheses into a single theoretical framework to understand how different factors play a role in accounting for the evolution of the skill premium. In addition, to the best of our knowledge, our research is the first of its kind in which the usual demand-driven explanations of the skill premium are coupled with endogenous labor supply considerations in an applied general equilibrium setup. This enables us to analyze and quantify both demand and supply factors that affect relative wages.

The rest of the paper is organized as follows. Section 2 presents the evolution of skill premium patterns as well as a brief overview of the Baltic economies. Section 3 describes the general equilibrium model and the analytical derivation of skill premium implied by the model. Section 4 describes how our parameters are calibrated and Section 5 describes the results of our numerical experiments. Section 6 checks for the robustness of our results with different sensitivity analyses, and we conclude in Section 7.

2. A Brief Overview of the Baltic Economies

2.1. The Skill Premium

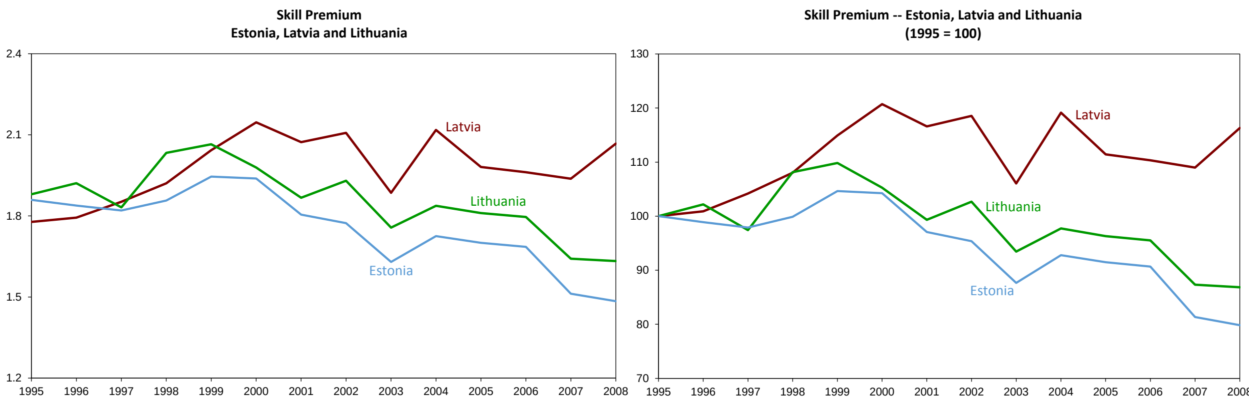
We construct skill premium series using the data in the Socio Economic Accounts (SEA) section of the World Input Output Database (WIOD). The database does not contain readily-available skill premium series (defined as the ratio of the skilled wage to the unskilled wage, or w_s/w_u) for the Baltic countries, but it includes series of both labor compensation and hours worked disaggregated by skill levels. This allows us to back out the skill premium series using the fact that:

$$\text{skill premium} \;=\; \frac{w_s}{w_u} \;=\; \frac{\frac{w_s L_s}{L_s}}{\frac{w_u L_u}{L_u}} \tag{1}$$

where L_s and L_u are hours worked by skilled and unskilled labor, and $w_s L_s$ and $w_u L_u$ are skilled and unskilled labor compensation, all of which are available in the WIOD.

We depict the constructed skill premium series in Figure 1, from 1995 (the first year of data availability in the WIOD) to 2008 (the year prior to the international financial crisis), both in absolute terms and also normalized so that they take the value of 100 in the initial year, to facilitate comparisons. A few facts are worth noting: the first one is that in 1995,

Figure 1



the skill premium exhibited quite similar values in all three Baltic countries. Second, in spite of this initial similarity, the Baltic skill premia took divergent paths: by 2008, the skill premium in Latvia had increased by approximately 16% relative to its 1995 value, while the skill premium in Estonia and Lithuania had declined by around 20% and 13% during the same period, respectively.

2.2. The Stock of Capital

As documented in Bems and Jönsson Hartelius (2006), right after regaining their independence the Baltic countries were capital-poor economies when compared to their pre-2004 expansion EU-15 peers. Since then, they have all expanded their stocks of capital quickly, both in the form of structures and of equipment.

Measures of capital stock decomposed by type are not readily available for the Baltic countries. However, the OECD National Accounts database presents Gross Fixed Capital Formation series disaggregated by type for all three Baltic countries. This allows us to construct structures and equipment capital stock series using the perpetual inventory method[1],

[1] We group "transport equipment," "ICT equipment" and "other machinery and equipment and weapon system" into a category we call "equipment capital," and "dwellings" and "other building structures" into a category we label as "structure capital."

according to which capital follows the law of motion:

$$K^j_{i,t+1} = (1 - \delta^j_i)K^j_{i,t} + I^j_{i,t} \tag{2}$$

where $K^j_{i,t}$ is stock of capital of type i in period t in country j, and δ^j_i and $I^j_{i,t}$ are the depreciation rate and investment in the corresponding sector and country in period t. To compute the initial level of each type of capital stock in each country (in our case, the initial year is 1995), we follow Hall and Jones (1999) and Caselli (2005) and set $K^j_{i,1995} = I^j_{i,1995}/(g^j_i + \delta^j_i)$, where g^j_i is the average growth rate of investment of type-i capital in country j. A summary of results is presented in Table 2.1:

Table 2.1. Growth Rates of Equipment and Structures Capital (1995-2008)

Country	Equipment capital stock growth rate (percent)	Structure capital stock growth rate (percent)	Equipment share in total capital stock (average fraction)
Estonia	431.0	254.3	0.28
Latvia	774.5	387.7	0.33
Lithuania	620.5	184.0	0.19

We find that, while in all three countries both types of capital grew at very fast rates, Latvia displays the highest growth rate of equipment capital stock, which is considered to be complementary to skilled labor. Moreover, the share of equipment capital in the total stock of capital is also the highest in Latvia.

2.3. Skill Composition of the Working-Age Population

The Baltic countries' populations are among the lowest in the European Union, with Estonia's population slightly exceeding 1 million, and Latvia and Lithuania surpassing the 2- and 3-million mark, respectively. All three countries exhibit a persistent population decline: between 1995-2008, Estonia's population shrank by 6.92%, Latvia's population declined by 12.38% and Lithuania's population decreased by 11.87% (data are taken from the World Bank's World Development Indicators database). The fraction of the population who are of working age (15-64 years old) is remarkably similar across the three countries, averaging approximately 67% for the 1995-2008 period.

To document the composition of the working-age population, we use the database constructed by Barro and Lee (2013). While all three countries exhibit increases in their skilled population, the growth rates are quite uneven: Lithuania leads the group with a 76.5% increase between 1995-2008, compared to Estonia's 53% and Latvia's 31% increases. Similarly, all three countries have experienced a reduction in their unskilled population, but again, the changes vary significantly across countries: Estonia exhibits the largest decrease in its unskilled population with a 15.3% decline, compared to the 10.2% and 5.8% decreases in Lithuania and Latvia, respectively. Thus, Latvia exhibits the smallest increase in skilled population and the smallest decrease in unskilled population among the Baltic countries. Table 2.2 below summarizes these facts:

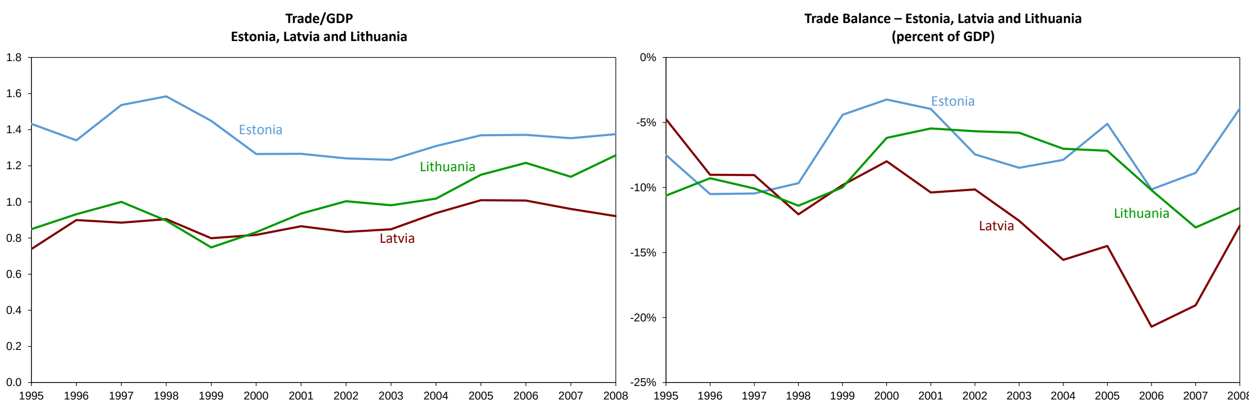
Table 2.2. Growth Rates of Skilled and Unskilled Working-Age Population (1995-2008)

Country	Total population (percent)	Working-age population fraction (average)	Skilled working-age population (percent)	Unskilled working-age population (percent)
Estonia	-6.9	67.3	53.0	-15.3
Latvia	-12.3	67.2	31.0	-5.8
Lithuania	-11.8	66.6	76.5	-10.2

2.4. The Foreign Sector

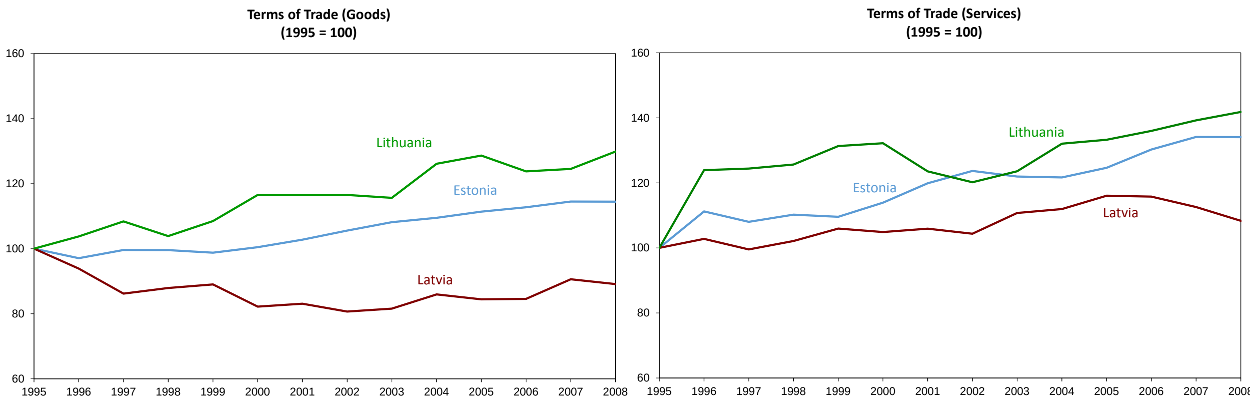
All Baltic countries are characterized by high degrees of openness (measured as the ratio of total trade relative to GDP), averaging 0.89 for Latvia, 1.00 for Lithuania and 1.37 for Estonia during the 1995-2008 period, and by the large and persistent trade deficits they have experienced since they opening their economies (see Figure 2).

Figure 2



As small and very open economies, the Baltics are obviously exposed to variations in their terms of trade (defined as the ratio of export prices to import prices). We use the Annual Macroeconomic Database (AMECO) compiled by the European Commission to calculate the series of terms of trade for goods and for services during the 1995-2008 period. A clear divergent pattern is evident for the goods terms of trade as Estonia and Lithuania experienced an improvement in the terms of trade, whereas Latvia experienced a deterioration in the terms of trade. On the other hand, all three countries experienced an improvement in the terms of trade in the services sector, but the magnitude of such improvement is much larger for Estonia and Lithuania than for Latvia (see Figure 3).

Figure 3



3. Model

Having established these data facts, we now study a simple general equilibrium model with endogenous labor-leisure decisions, international trade, and complementarity between skilled labor and equipment capital in the production technology. We construct an economy with two countries: a Baltic country (Estonia, Latvia or Lithuania) and the rest of the world (ROW). The Baltic country is populated by several agents: two representative households (differentiated by their skills levels), producers, and a domestic government. Since our focus is on the Baltic countries, the rest of the world is modeled in a simpler fashion. The preferences and technologies of the agents in our model, as well as the way they interact with each other, are described in more detail below.

3.1. Production

Four commodities are produced in each Baltic country: unskilled-intensive goods, skilled-intensive goods, unskilled-intensive services and skilled-intensive services. We denote the set of commodities by G. Each commodity i is made up of a domestic component $y_{d,i}$ and a foreign component $y_{f,i}$ imported from the same sector in the rest of the world. The domestic and imported components are combined using an Armington aggregator of the form:

$$y_i = \phi_i \left[\delta_i y_{d,i}^{\rho_{m,i}} + (1-\delta_i) y_{f,i}^{\rho_{m,i}} \right]^{\frac{1}{\rho_{m,i}}} \tag{3}$$

where $\rho_{m,i}$ is the parameter that governs the elasticity of substitution between domestic and imported components in sector i, δ_i is the parameter which governs the share of imports in the production of commodity i, and ϕ_i is the parameter that reflects the level of productivity in the final goods production in sector i. Imports of commodity i are purchased at the international price $\bar{p}_{f,i}$, which the Baltic economies take as given, and are subject to an ad-valorem tariff rate $\tau_{f,i}$, while purchases of the domestic component are subject to a production tax rate t_i.

3.2. Domestic Component Producer

The domestic component $y_{i,d}$ is produced using intermediate inputs from all sectors $x_{j,i}$ in fixed proportions, capital structures and equipment $k_{s,i}$ and $k_{e,i}$, and skilled and unskilled labor $\ell_{s,i}$ and $\ell_{u,i}$:

$$y_{d,i} = \min\left\{\frac{x_{1,i}}{a_{1,i}}, \ldots, \frac{x_{n,i}}{a_{n,i}}, \beta_i k_{s,i}^{\alpha_i}\left[\lambda_i\left[\mu_i k_{e,i}^{\rho} + (1-\mu_i)\ell_{s,i}^{\rho}\right]^{\frac{\sigma}{\rho}} + (1-\lambda_i)\ell_{u,i}^{\sigma}\right]^{\frac{1-\alpha_i}{\sigma}}\right\} \tag{4}$$

where $a_{j,i}$ is the unit requirement of intermediate input j in the production of commodity i; α_i, μ_i and λ_i are the share parameters of inputs in value added; β_i is the parameter that reflects the level of productivity in the domestic production in sector i; ρ is the elasticity of substitution between equipment and skilled labor; and σ is the elasticity of substitution between unskilled labor and equipment or skilled labor. We follow Krusell et al. (2000) in assuming that value added is produced as Cobb-Douglas combination of structures and a CES combination of equipment and skilled and unskilled labor.

3.3. Investment Good

We include an investment good in order to account for the savings observed in the data. In a dynamic model, agents save in order to enjoy future consumption. In a static model like the one we use, agents derive utility from consuming the investment good, just as they derive utility from the consumption goods. The investment good y_{inv} is produced by a firm that combines the final goods as intermediate inputs using a fixed proportions technology, as shown:

$$y_{inv} = \min\left\{\frac{x_{1,inv}}{a_{1,inv}}, \ \ldots, \frac{x_{i,inv}}{a_{i,inv}}, \ \ldots, \frac{x_{n,inv}}{a_{n,inv}}\right\} \tag{5}$$

3.4. Households

Each Baltic country is populated by two representative households: skilled and unskilled. We denote the set of household by H. Each household $j \in H$ chooses consumption, savings and leisure to maximize utility:

$$\left[\gamma_j\left(\sum_{i\in G}\theta_i^j c_{i,j}^{\eta} + \theta_{inv}^j (c_{inv,j} + c_{b,j})^{\eta}\right)^{\frac{\psi}{\eta}} + (1-\gamma_j)(\bar{L}_j - \ell_j)^{\psi}\right]^{\frac{1}{\psi}} \tag{6}$$

subject to the budget constraint

$$\sum_{i\in G} p_i c_{i,j} + p_{inv}(c_{inv,j} + c_{b,j}) = (1 - t_d^j)(w_j \ell_j + r_e \bar{k}_{e,j} + r_s \bar{k}_{s,j})$$

where $c_{i,j}$ is consumption of commodity i by household j and p_i its price; $\bar{L}_j$ is the total number of available hours and ℓ_j is hours worked; $\varepsilon_c = 1/(1-\eta)$ is the elasticity of substitution among consumption goods, and $\varepsilon_\ell = 1/(1-\psi)$ is the elasticity of substitution between the consumption aggregate and leisure; θ_i^j and γ_j are share parameters in household j's preferences; t_d^j is the direct tax rate levied on household j; w_j is the wage rate for skilled or unskilled labor; $\bar{k}_{e,j}$ and $\bar{k}_{s,j}$ are the equipment and structures endowments household j; and r_e and r_s their respective rental rates.

Here $c_{inv,j}$ denotes the purchases of the investment good by household j and p_{inv} its price. If the government runs a deficit, we assume that it sells government bonds to the households to finance such deficit. Thus, $c_{b,j}$ denotes the purchases of government bonds by household j. We follow Kehoe and Serra-Puche (1983) and assume that households treat government bonds and the investment good as perfect substitutes. Consequently, $c_{inv,j}$ and $c_{b,j}$ account for the savings of household j.

3.5. Government

The government in the Baltic country imposes taxes and sells bonds to finance the purchases of consumption and services $c_{i,g}$, which are ranked according to the utility function

$$\sum_{i \in G} \theta_i^g \log c_{i,g} \tag{7}$$

These purchases must satisfy the government's budget constraint

$$\sum_{i \in G} p_i c_{i,g} = \sum_{j \in H} t_d^j (w_j \ell_j + r_e \bar{k}_{e,j} + r_s \bar{k}_{s,j}) + \sum_{i \in G} t_i p_i y_{d,i} + \sum_{i \in G} e_f \tau_{f,i} \bar{p}_{f,i} y_{f,i} + \sum_{j \in H} p_{inv} c_{b,j}$$

The left-hand side of the budget constraint includes purchases of goods and services. The first term in the right-hand side includes the direct taxes levied on the households; the second and third term denote production taxes and tariff revenues, respectively; the last term represents the sales of bonds to the households.

3.6. Rest of the World

We model a single representative household in the rest of the world that purchases imported goods $x_{f,i}$ from the Baltic country and consumes its local good $x_{f,f}$ to maximize utility

$$\left[\sum_{i \in G} \theta_i^f x_{f,i}^{\rho_x} + \theta_{inv}^f x_{f,inv}^{\rho_x} + \theta_f^f x_{f,f}^{\rho_x} - 1 \right] / \rho_x \tag{8}$$

subject to the budget constraint

$$\sum_{i \in G} (1 + \tau_i^f) p_i x_{f,i} + p_{inv} x_{f,inv} + e x_{f,f} = e I_f$$

where τ_i^f is the ad-valorem tariff rate that the rest of the world imposes on Baltic imports of commodity i; $1/(1-\rho_x)$ is the export elasticity of substitution; I_f is the income in the rest of the world; e is the real exchange rate; and $x_{f,inv}$ are the purchases of the Baltic investment good by the rest of the world in order to account for the Baltic country's trade deficit (i.e., foreigners saving in the Baltic economy).

3.7. Definition of Equilibrium

An equilibrium for this economy consists of a set of prices $\{p_i\}_{i\in G}$ for the final goods; $\{p_{d,i}\}_{i\in G}$ for the domestic components; and p_{inv} for the investment good; factor prices w_s, w_u, r_e, r_s; an exchange rate e; foreign prices $\{\bar{p}_{f,i}\}_{i\in G}$; a consumption plan for each type of household j $(\{c_{i,j}\}_{i\in G}, c_{inv,j}, c_{b,j})$; a consumption plan for the government $\{c_{i,g}\}_{i\in G}$; a consumption plan for the household in the rest of the world $(\{x_{f,i}\}_{i\in G}, x_{f,inv}, x_{f,f})$; a production plan for the producer of commodity i $(y_i, y_{f,i}, x_{1,i}, ...x_{n,i}, k_{e,i}, k_{s,i}, \ell_{u,i}, \ell_{s,i})$; and a production plan for the investment good firm $(y_{inv}, x_{1,inv}, ..., x_{n,inv})$; such that, given the tax rates and the tariff rates:

(i) The consumption plan $(\{c_{i,j}\}_{i\in G}, c_{inv,j}, c_{b,j})$ maximizes the utility of household j subject to its budget constraint.

(ii) The consumption plan $\{c_{i,g}\}_{i\in G}$ maximizes the government's utility subject to its budget constraint.

(iii) The consumption plan $(\{x_{f,i}\}_{i\in G}, x_{f,inv}, x_{f,f})$ maximizes the utility of the household in the rest of the world subject to its budget constraint.

(iv) The production plan $(y_{d,i}, x_{1,i}, ...x_{n,i}, k_{e,i}, k_{s,i}, \ell_{u,i}, \ell_{s,i})$ satisfies:

$$\begin{aligned} y_{d,i} &= \min\left\{\frac{x_{1,i}}{a_{1,i}}, \ldots, \frac{x_{n,i}}{a_{n,i}}, \beta_i k_{s,i}^{\alpha_i}\left[\lambda_i\left[\mu_i k_{e,i}^{\rho} + (1-\mu_i)\ell_{s,i}^{\rho}\right]^{\frac{\sigma}{\rho}} + (1-\lambda_i)\ell_{u,i}^{\sigma}\right]^{\frac{1-\alpha_i}{\sigma}}\right\} \\ &\text{and } (1-t_{p,i})p_{d,i}y_{d,i} - \sum_{j\in \mathsf{G_p}} p_j x_{j,i} - w_u\ell_{u,i} - w_s\ell_{s,i} - r_e k_{e,i} - r_s k_{s,i} \leq 0, \; = 0 \text{ if } y_{i,d} > 0 \end{aligned}$$

(iv) The production plan $(y_i, y_{d,i}, y_{f,i})$ satisfies:

$$p_i y_i - p_{d,i}y_{d,i} - (1+\tau_{f,i})e\bar{p}_{f,i}y_{f,i} \leq 0, \; = 0 \text{ if } y_i > 0$$

where $y_{d,i}$ and $y_{f,i}$ solve:

$$\begin{aligned} \min \quad & p_{d,i}y_{d,i} + (1+\tau_{f,i})e\bar{p}_{f,i}y_{f,i} \\ \text{s.t.} \quad & \phi_i\left[\delta_i y_{d,i}^{\rho_{m,i}} + (1-\delta_i y_{f,i}^{\rho_{m,i}}\right]^{\frac{1}{\rho_{m,i}}} = y_i \end{aligned}$$

(vi) The production plan $(y_{inv}, x_{1,inv}, ..., x_{n,inv})$ satisfies:

$$\begin{aligned} y_{inv} &= \min\left\{\frac{x_{1,inv}}{a_{1,inv}}, \, ... \, , \frac{x_{i,inv}}{a_{i,inv}}, \, ... \, , \frac{x_{n,inv}}{a_{n,inv}}\right\} \\ \text{and} \quad & p_{inv}y_{inv} - \sum_{j \in \mathsf{G_p}} p_j x_{j,inv} \leq 0, = 0 \ \text{ if } \ y_{inv} > 0 \end{aligned}$$

(viii) The factor markets clear:

$$\begin{aligned} \sum_{i \in G} \ell_{u,i} &= \ell_u \\ \sum_{i \in G} \ell_{s,i} &= \ell_s \\ \sum_{i \in G} k_{e,i} &= \sum_{j \in H} \bar{k}_{e,j} = \bar{K}_e \\ \sum_{i \in G} k_{s,i} &= \sum_{j \in H} \bar{k}_{s,j} = \bar{K}_s \end{aligned}$$

(ix) The goods markets clear:

$$\begin{aligned} y_i &= \sum_{j \in G} x_{j,i} + x_{i,inv} + \sum_{j \in H} c_{i,j} + c_{i,g} + x_{f,i} \qquad \forall i \in G \\ y_{inv} &= \sum_{j \in H} c_{inv,j} + x_{f,inv} \end{aligned}$$

(x) The balance of payments condition is satisfied:

$$\sum_{i \in G} e\bar{p}_{f,i} y_{f,i} = \sum_{i \in G} p_i x_{f,i} + p_{inv} x_{f,inv}$$

3.8. The Skill Premium in the Model

From the first-order conditions of the firm that produces the domestic component $y_{d,i}$, we can derive the expression for the skill premium, which we denote as π, as follows:

$$\begin{aligned} \pi = \frac{w_s}{w_u} &= \frac{\lambda_i(1-\mu_i)}{1-\lambda_i} \left[\mu_i k_{e,i}^{\rho} + (1-\mu_i)\ell_{s,i}^{\rho}\right]^{\frac{\sigma-\rho}{\rho}} \frac{\ell_{s,i}^{\rho-1}}{\ell_{u,i}^{\sigma-1}} \\ &= \frac{\lambda_i(1-\mu_i)}{1-\lambda_i} \left[\mu_i \left(\frac{k_{e,i}}{\ell_{s,i}}\right)^{\rho} + (1-\mu_i)\right]^{\frac{\sigma-\rho}{\rho}} \left(\frac{\ell_{s,i}}{\ell_{u,i}}\right)^{\sigma-1} \end{aligned} \tag{9}$$

Log-linearizing the expression in equation (9) and taking derivative with respect to time, we obtain the following expression, similar to one found in Krusell et al. (2000).

$$g_\pi \simeq \mu_i(\sigma-\rho)\left(\frac{k_{e,i}}{\ell_{s,i}}\right)^\rho (g_{k_{e,i}} - g_{\ell_{s,i}}) + (\sigma-1)(g_{\ell_{s,i}} - g_{\ell_{u,i}}) \quad \forall i \in G \tag{10}$$

where g_x denotes the growth rate of variable x. Similar to Krusell et al. (2000), the growth rate of skill premium depends on the relative growth rates of equipment capital and skilled labor (captured by the first term in equation (10)) and the relative growth rates of skilled and unskilled labor (captured by the second term in equation (10)). Additionally, as we have disaggregated sectors with different skill intensity, the growth rate of skill premium also depends on the between-sector reallocation of factors. This incorporates the Heckscher-Ohlin (H-O) mechanism where reductions in trade costs shift factors of production towards sectors that a country has comparative advantage in, and thus raise the relative return to the factor that is more intensively used in those sectors.

4. Calibration and Simulation

Most of the parameters (such as the input shares and total factor productivity scale parameters in the production functions, as well as the parameters in the agents' utility functions) can be directly calibrated from a social accountring matrix (SAM) by using the optimality and market clearing conditions and choosing physical units such that prices (including factor prices) are equal to one in the base case. A SAM is a record of all the transactions that take place in an economy during a given period of time, typically one year. It provides a snapshot of the structure of production, where the row entries record the receipts of a particular agent and the column entries represent the payments made by the agents. Depending on the data availability, it can provide a much disaggregated level of institutional detail, with different types of firms, levels of government, households that differ in basic demographic characteristics and several trade partners. We first create an aggregate SAM for each of the Baltic countries using the data from the World Input-Output Database (WIOD). Our base year is 1995 as it is the earliest year in which we can obtain the input-output database for the Baltic countries. In Appendix 1, we describe how we group different sectors into 4 aggregate sectors: unskilled-intensive goods (GU), skilled-intensive goods (GS), unskilled-intensive services (SU) and skilled-intensive services (SS).

In addition, with help of the Household Budget Surveys (HBS), we divide the aggregate households into 2 groups according to the educational attainment level of the household head: "high skill" workers (or simply, "skilled" workers for those with tertiary education) and "low skill" workers (or "unskilled" workers for those without tertiary education). The WIOD also provides Socio Economic Accounts (SEA) for each countries under survey which contain industry-level data on employment (number of workers and educational attainment), capital stocks, gross output and value added at current and constant prices. We use this information to assign labor compensation for each type of households. Finally, our model incorporates labor-leisure choice, and we first assume that each type of agents are endowed with a maximum number of hours available, taken to be 5200 per year (100 hours per week × 52 weeks per year). This corresponds to $\bar{L}_j$ in the model. As the Socio Economic Accounts (SEA) from the WIOD provide information on total hours worked in each sector as well as the fraction of hours worked by skilled and unskilled workers for each sectors, we can back out the total hours spent on leisure as the difference between total endowment of time and total hours worked by each type of workers. The values of our calibrated parameters are detailed in Appendix 2.

In our model, some parameters cannot be calibrated directly from the SAM or other data. We explain below our choice of parameter values taken from the literature for our benchmark experiment as summarized in Table 4.1.

Table 4.1. Parameters and Target Elasticities

Parameter	Value	Elasticities	Definition	Value
$\rho_{m,i}$	0.827	$\varepsilon_{m,i}$	Import vs. domestic production i	5.78
ρ_x	0.9	ε_x	Export vs. foreign local good	10
ρ	-0.5	ε_s	Capital vs. skilled labor	0.67
σ	0.4	ε_u	Capital vs. unskilled labor	1.67
η	-1	ε_c	Consumption goods	0.5
ψ	-0.25	ε_l	Consumption vs. leisure	0.8

First, the import elasticity of substitution in sector i, $\varepsilon_{m,i}$, is governed by the parameter $\rho_{m,i}$ in equation (3) $\left(\varepsilon_{m,i} = \frac{1}{1-\rho_{m,i}}\right)$ and we pick a value of 0.827. This value is taken as the average of values preferred by Ruhl (2008) (0.844), Simonovska and Waugh (2014) (0.758), and Eaton and Kortum (2002) (0.879). Note that our choice of $\rho_{m,i}$ implies that the elasticity of substitution between domestic and imported components is equal to 5.78.[2] Similarly, the export elasticity of substitution, ε_x, governed by the parameter ρ_x, is given as 10 (or $\rho_x = 0.9$) which falls near the median range of values used in the existing literature. Next, in the domestic production function, the parameter ρ governs the elasticity of substitution between capital equipment and skilled labor, ε_s, while the parameter σ governs the elasticity of substitution between capital equipment (or skilled labor) and unskilled labor, ε_u. Following Krusell et al. (2000), we pick values of ρ and σ such that capital is more substituable with unskilled labor than with skilled labor. [3] Finally, in the household utility function, the parameter η governs the elasticity of substitution among different consumption and investment goods. Following Stockman and Tesar (1995), we take $\eta = -1$ such that the elasticity of substitution between consumption goods is equal to 0.5. For the elasticity of substitution between aggregate consumption and leisure, we follow Auerbach and Kotlikoff (1987)

[2]Due to lack of sectoral data and literature on sectoral elasticities, we abstract from having different elasticities of import substitution across sectors.

[3]Note that when $\sigma = \rho \to 0$, we have a Cobb-Douglas production function with no complementarity between capital and skilled labor. We test this implication later in the sensitivity analysis.

and choose $\psi = -0.25$ which implies the elasticity of substitution between consumption and leisure to be 0.8, which is approximately equal to the direct estimate of Ghez and Becker (1975).[4]

4.1. Numerical Experiments

Once we solve for the equilibrium with calibrated parameters, we move on to conduct a series of numerical experiments in order to establish the link between the stylized facts we mentioned earlier in Section 2. We then ask the following question: How would different labor markets react in our model if we were to feed in these stylized facts one by one, and then jointly? This is an informative exercise since changes in skill premium depends on different reactions in the demand for skilled and unskilled workers, and the model allows us to trace the various channels that affect skill premium. Here we describe each of the experiments we implement.

Changes in the terms of trade (TOT). While the three countries experienced similar increases in the volume of exports and imports, we noticed that terms of trade, defined as the price ratio of exports to imports, have in fact diverged as shown in Section 2. We note that in the goods sector, both Estonia and Lithuania experienced an improvement (or an increase) in the terms of trade in the terms of trade) while the opposite took place in Latvia with a deterioration (or a decrease) in the terms of trade. We explore whether this diverging patterns of terms of trade has an explanatory role in the divergence of skill premium. In the experiment, we allow the exogenously-given price of foreign inputs for final production, $\bar{p}_{f,i}$, to adjust accordingly to match the observed changes in the terms of trade shown in Table 4.2.

Table 4.2: Numerical Experiment - Changes in the Terms of Trade (1995-2008)

	Estonia		Latvia		Lithuania	
	Goods	Service	Goods	Service	Goods	Service
Changes in TOT	14.47%	34.04%	-10.87%	8.33%	29.87%	41.82%

Capital deepening. As the Baltic countries transitioned from being a part of Soviet economy towards a fully market-oriented economy, they experienced a significant increase in the stock of capital in the form of foreign direct investment and domestic investment. As the model incorporates complementarity between skilled labor and equipment capital, we break down capital stock into equipment and structure for each of the countries we study using the methodology specified in Section 2. We then simulate the growth in capital equipment by increasing the aggregate stock

[4]Auerbach and Kotlikoff (1987) runs a robustness check with $\psi = -1.5$ which implies a lower elasticitity of substitution of 0.4, while we have a unit elastic log utility in consumption and leisure when $\psi \to 0$. We try with these values later in the sensitivity analysis.

of capital equipment $\bar{K}_e$ by the observed rates as shown in Table 4.3 below. With cross-country differences in the observed growth rates of capital equipment, we expect a country that experienced a higher growth rate to be associated with increased utilization of skilled labor and thus a larger increase in the skill premium.

Table 4.3: Numerical Experiment - Capital Deepening (1995-2008)

	Estonia		Latvia		Lithuania	
	Equipment	Structure	Equipment	Structure	Equipment	Structure
Changes in capital	430.99%	254.28%	774.53%	387.67%	620.51%	183.99%

Changes in the relative skill supply. All three Baltic countries experienced similar changes in demographics: a shrinking size of population coupled with an increase in college-graduates. Taking the cross-country dataset by Barro and Lee (2013), we calculate the changes in the number of skilled and unskilled workers as shown in Table 4.4 and feed this information into $\bar{L}_j$.

Table 4.4: Numerical Experiment - Relative Skill Supply (1995-2008)

	Estonia		Latvia		Lithuania	
	Skilled	Unskilled	Skilled	Unskilled	Skilled	Unskilled
Changes in demographics	53.0%	-15.3%	31.0%	-5.8%	76.5%	-10.2%

5. Benchmark Results

We first report the results from our joint experiment where we simultaneously incorporate the changes in the terms of trade, capital deepening, and the changes in demographics. As shown in Table 5.1, our simulation generates a decrease in skill premium for Estonia and Lithuania and an increase in skill premium for Latvia, as in the data.

Table 5.1: Benchmark Results - Skill Premium Changes (1995-2008)

	Estonia	Latvia	Lithuania
Joint simulation	-23.11%	10.02%	-29.55%
Data	-20.16%	16.31%	-13.15%

In order to assess the roles of each exogenous factors, we now move to discuss the simulation results for each of the individual simulations.

Changes in the terms of trade (TOT). First regarding changes in the TOT, both Estonia and Lithuania experienced an improvement in the TOT for all sectors with the service sectors benefitting more than the goods sectors. In Latvia, on the other hand, the TOT in the goods sectors deteriorated while the TOT in the service sectors improved. As such, trade increases in all sectors in Estonia and Lithuania, while Latvia experiences a fall in trade in the goods sector and an increase in trade in the service sector. For all countries, changes in the TOT are associated with a decrease in the skill premium. The magnitude of the fall in the skill premium is largest in Estonia at 4.7% and smallest in Latvia at 1.4%. In Estonia and Lithuania, changes in the skill premium came from a larger increase in unskilled wages over skilled wages, whereas in Latvia, changes in skill premium came from a larger decrease in skilled wages over unskilled wages. This is due to the fact that the former two experienced a positive trade shock while Latvia experienced a negative trade shock.[5] Despite different wage dynamics for different types of workers, the underlying force on the evolution of skill premium is coming from sectoral reallocation of resources from skilled sectors towards unskilled sectors. To see this, we note that the production of domestic component in the skilled service sector (the most skill-intensive sector) falls while the production of domestic component in the goods sectors rise in all the three countries. Similarly, factor resources (both skilled and unskilled labor) move away from skill-intensive sectors towards unskill-intensive sectors. This reflects the H-O mechanism where the Baltic countries shift their resources towards sectors in which they have comparative advantage, which are sectors that are relatively intensive in unskilled labor, relative to their main trade partners, the European Union. The impact of changes in the TOT are shown in Table 5.2 below.

Table 5.2: Benchmark Results - Changes in the Terms of Trade

[5]While we do not report in this paper, AMECO database also provides a weighted average of TOT for all industries. In Latvia, the aggregate TOT deteriorated by 1.87%, whereas the corresponding numbers for Estonia and Lithuania were showing an improvement by a margin of 29.10% and 32.02%, respectively.

	Estonia	Latvia	Lithuania
Skill premium	-4.73%	-1.35%	-1.55%
Wage (unskilled)	14.86%	-2.70%	22.37%
Wage (skilled)	9.42%	-4.01%	20.48%
Imports			
GU	97.85%	-42.52%	279.47%
GS	77.44%	-33.00%	273.66%
SU	391.80%	60.10%	659.79%
SS	339.27%	55.23%	775.41%
Exports			
GU	95.84%	-26.15%	235.27%
GS	165.78%	-43.97%	467.71%
SU	73.02%	1.22%	30.28%
SS	67.86%	5.09%	-11.01%
Final output			
GU	33.61%	-6.16%	68.59%
GS	42.96%	-6.76%	125.08%
SU	24.21%	1.52%	17.49%
SS	9.01%	0.59%	8.60%
Domestic output			
GU	13.38%	3.11%	1.70%
GS	9.81%	21.49%	11.09%
SU	5.21%	-2.07%	-0.89%
SS	-16.52%	-2.08%	-6.28%
Unskilled labor demand			
GU	9.71%	2.80%	-0.44%
GS	5.80%	21.05%	8.84%
SU	0.41%	-2.64%	-3.37%
SS	-21.43%	-2.96%	-8.93%
Skilled labor demand			
GU	18.44%	4.31%	2.69%
GS	14.19%	22.88%	12.11%
SU	8.53%	-1.00%	-0.51%
SS	-15.06%	-1.18%	-6.36%

Capital deepening. Regarding changes in capital stock, what matters for skill premium is the change in the stock of capital equipment which shows complementarity with skilled labor in the production function. As the stock of capital equipment increased as much as 8.7 times in Latvia and 5.3 times in Estonia, skill premium also increased the most in Latvia by around 49.5% while the increase in Estonia and Lithuania were 27.9% and 29.9%, respectively. For all countries, this increase in skill premium came from a disproportionately larger increases in the skilled wages over unskilled wages. Compared to the TOT experiment where skill premium changes were driven by "between"-sector reallocation of resources from skill-intensive to unskill-intensive sectors, under the capital deepening experiment, we see a "within"-sector reallocation of factors. In the aggregate, demand for unskilled labor falls in all countries, while the overall demand for skilled labor falls for Estonia and Lithuania but rises slightly in Latvia. Looking at different sectors, in both goods sectors, unskilled workers are replaced with skilled workers in all three countries. In the service sectors, the replacement effect is weaker or even reversed in some sectors. While we do not see skilled workers replacing unskilled workers in all the sectors, we expect that the skill premium increases from our capital deepening simulation. This is due to that fact that the degree of complementarity between capital equipment and skilled labor is larger in the goods sectors than in the service sectors, as captured in the parameter μ in equation (10). As shown in Appendix 2, not only are the calibrated values of μ_i higher in the goods sectors than in the service sectors, they are also the highest in Latvia where skill premium increase was the largest. The impact of changes in the stock of capital equipment are shown in Table 5.3 below.

Table 5.3: Benchmark Results - Changes in the Equipment Capital

	Estonia	Latvia	Lithuania
Skill premium	27.89%	49.52%	29.86%
Wage (unskilled)	42.74%	85.70%	67.94%
Wage (skilled)	82.55%	177.67%	118.08%
Domestic output			
GU	43.86%	88.02%	79.35%
GS	59.27%	122.88%	69.41%
SU	47.00%	100.43%	71.59%
SS	60.45%	98.63%	62.87%
Equipment capital demand			
GU	475.27%	1030.32%	830.40%
GS	507.19%	1064.57%	675.77%
SU	414.22%	737.93%	576.96%
SS	413.00%	628.62%	499.93%
Unskilled labor demand			
GU	-5.11%	-13.62%	-10.85%
GS	-3.13%	-4.99%	-3.48%
SU	-1.66%	-9.93%	-10.01%
SS	0.84%	-3.03%	1.38%
Total	-2.46%	-9.56%	-7.53%
Skilled labor demand			
GU	4.81%	38.94%	35.50%
GS	10.63%	43.15%	12.98%
SU	-6.31%	3.00%	-1.41%
SS	-6.53%	-10.43%	-12.63%
Total	-4.28%	1.37%	-2.67%

Changes in the relative skill supply. Regarding demographic changes, all three countries experienced an increase in the number of skilled workers and a decrease in the number of unskilled workers. This is due to an increase in the number of college graduates coupled with a decrease in the total working-age population size. As relative skill supply increases, we see a decrease in skill premium. This is shown by an increase in the wages of unskilled workers (as unskilled workers become more scarce) and a decrease in the wages of skilled workers (as the number of skilled workers increase). As unskilled workers become scarce, the unskilled goods (GU) sector, which is the sector that utilizes most of the unskilled workers, shows a decrease in its domestic production. On the contrary, the skilled service (SS) sector experiences the largest increase in domestic production in all three countries as this sector most intensively utilizes skilled workers. In terms of reallocation of skilled and unskilled workers, we see a shift in demand towards skilled workers and away from unskilled workers in the aggregate as well as for each sectors. The detailed sectoral impact of changes in the skill supply are shown in Table 5.4.

Table 5.4: Benchmark Results - Changes in the Skill Supply

	Estonia	Latvia	Lithuania
Skill premium	-41.64%	-28.59%	-48.93%
Wage (unskilled)	18.98%	6.88%	13.68%
Wage (skilled)	-30.57%	-23.68%	-41.94%
Domestic output			
GU	-0.85%	-2.44%	-0.40%
GS	4.28%	1.24%	7.23%
SU	6.65%	2.83%	7.15%
SS	13.62%	6.76%	17.61%
Unskilled labor demand			
GU	-18.52%	-8.10%	-12.02%
GS	-15.73%	-6.13%	-10.97%
SU	-23.52%	-9.65%	-17.94%
SS	-26.83%	-13.17%	-27.99%
Total	-21.86%	-9.63%	-17.26%
Skilled labor demand			
GU	62.46%	29.48%	78.21%
GS	66.04%	33.58%	101.07%
SU	61.16%	34.49%	90.93%
SS	55.83%	34.32%	88.23%
Total	58.97%	33.77%	88.55%

6. Sensitivity Analyses

6.1. The Role of Trade Elasticities

A relevant question for our benchmark simulation is whether our results depend on the choice of the trade elasticities. To assess the robustness of our results, we re-run our simulations using an alternative set of values of trade elasticities. First, we look at a different set of values for ρ_m as shown in Table 6.1. These values are taken from Simonovska and Waugh (2014) (0.758), Ruhl (2008) (0.844), and Eaton and Kortum (2002) (0.879), with our benchmark value of 0.827 (in bold font) taken as the simple average. We note that different import elasticities of substitution has little impact on the skill premium changes under the joint simulation but has implications under our terms of trade (TOT) experiment. Given that we have elasticities ranging from 4.13 to 8.26, a 100% increase in elasticity under the TOT experiment is associated with an additional decrease in skill premium of around 4.5 percentage point in Estonia (-3% to -7.5%), 3.4 percentage point in Lithuania (-0.4% to -3.8%), and 1.7 percentage point in Latvia (-0.7% to -2.4%). The fact that higher elasticities of import substitution is associated with a larger changes in skill premium is a reflection of Heckscher-Ohlin mechanism in place in our model where the larger the volume of trade the greater the magnitude of shift towards sectors that utilize more of unskilled labor in which these countries have comparative advantages.

Table 6.1: Sensitivity Results - Changes in the Import Elasticity Parameter

		Change in Skill Premium		
ρ_m	Simulation	Estonia	Latvia	Lithuania
0.758	Joint	-22.79%	10.54%	-29.26%
	TOT	-3.02%	-0.67%	-0.35%
0.827	Joint	-23.11%	10.02%	-29.55%
	TOT	-4.73%	-1.35%	-1.55%
0.844	Joint	-23.24%	9.85%	-29.68%
	TOT	-5.42%	-1.61%	-2.08%
0.879	Joint	-23.69%	9.39%	-30.15%
	TOT	-7.49%	-2.38%	-3.82%

Next, we run a similar robustness check with different values of export substitution elasticity. We pick a value of ρ_x that is equal to the benchmark value for ρ_m and another value that is associated with an increase in the export elasticity of substitution by 100%. We compare the results of the joint and individual experiment in Table 6.2. Similar to the sensitivity analysis with the import elasticity of substitution, changing ρ_x only affects our results under the TOT experiment. Given the range of elastities ranging from 5.78 to 11.56 (benchmark value coresopnds to 10), a 100% increase in export elasticity is associated with an additional decrease in skill premium of around 1.3 percentage point in Estonia to 1.5 percentage point in Lithuania. In Latvia, however, the sign is reversed as an increase in export elasticity is associated with an additional increase in skill premium of around 0.5 percentage point.

Table 6.2: Sensitivity Results - Changes in the Export Elasticity Parameter

		Change in Skill Premium		
ρ_x	Simulation	Estonia	Latvia	Lithuania
0.827	Joint	-23.17%	9.50%	-29.24%
	TOT	-3.79%	-1.70%	-0.47%
0.9	Joint	-23.11%	10.02%	-29.55%
	TOT	-4.73%	-1.35%	-1.55%
0.9135	Joint	-23.10%	10.22%	-29.73%
	TOT	-5.06%	-1.23%	-1.96%

6.2. The Role of Capital-Skill Complementarity

In the benchmark experiment, we used the values reported by Krusell et al. (2000), and the implied factor elasticities of substitution were higher for capital and unskilled labor than for capital and skilled labor. In this sensitivity experiment, we assess our underlying assumption of capital-skill complementarity in the production technology. We first test a Cobb-Douglas specification ($\rho = \sigma = 0$) where the elasticity of substitution between capital and skilled labor and capital and unskilled labor are equal to one. In another test, we strengthen the degree of capital-skill complementary by picking the simple average of the parameter values used in Polgreen and Silos (2008), which are $\rho = -0.357$ and $\sigma = 0.659$. We show the simulation results and compare with the benchmark results (in bold fonts) in Table 6.3 below. Under a Cobb-Douglas specification, since $\rho = \sigma$, the first term in the equation (10) disappears and the skill premium only depends on the growth rate of relative skill supplies. Thus, increases in capital equipment plays no role in the evolution of skill premium. In addition, as the value of σ governs the elasticity of substitution between capital and unskilled labor, the larger the value of σ (or the larger the elasticity), the smaller the effect of relative skill supplies on skill premium.

Table 6.3: Sensitivity Results - Changes in the Production Technology Parameters

			Change in Skill Premium		
ρ	σ	Simulation	Estonia	Latvia	Lithuania
0	0	Joint	-49.54%	-33.89%	-54.44%
		TOT	-6.79%	-1.56 %	-2.42%
		Capital Deepening	0.45%	-1.77%	-0.13%
		Skill Supply	-48.44%	-31.33%	-54.08%
-0.5	**0.4**	Joint	-23.11%	10.02%	-29.55%
		TOT	-4.73%	-1.35%	-1.55%
		Capital Deepening	27.89%	49.52%	29.86%
		Skill Supply	-41.64%	-28.59%	-48.93%
-0.357	0.659	Joint	-5.48%	37.10%	-9.70%
		TOT	-3.02%	-1.03%	-0.93%
		Capital Deepening	33.82%	72.15%	40.96%
		Skill Supply	-31.39%	-23.01%	-39.84%

6.3. The Role of Preference for Consumption, Labor, and Leisure

In the utility function, the parameter η governs the elasticity of substitution between different consumption goods and investment good. As shown in Table 6.4 below, when we change this parameter from -1 in the bechmark case to 0 (which implies a log-utility specification), we do not see any changes in the evolution of the skill premium under various simulations.

Next we look at varying the degree of elasticity between aggregate consumption and leisure, with the value of $\phi = 0$ implying a Cobb-Douglas type preference over aggregate consumption and leisure and $\phi = -1.5$ referring to a case where the elasticity of substitution of 0.4 is exactly half the elasticity value chosen in the benchmark simulation. With a lower elasticity of substitution between consumption and leisure, the magnitude of skill premium changes are larger when we simulate changes in the capital stock and the changes in the relative skill supplies. Finally, we look at the case where leisure does not enter into our utility function and labor is inelastically supplied by setting $\epsilon_j = 1$ in the utility function. While labor-leisure decision is no longer endogenously determined, the implications from the joint experiment remains unchanged.

Table 6.4: Sensitivity Results - Changes in the Preference Parameters

			Change in Skill Premium		
η	ψ	Simulation	Estonia	Latvia	Lithuania
0	-0.25	Joint	-23.22%	10.18%	-29.68%
		TOT	-4.77%	-1.28%	-1.91%
		Capital Deepening	27.97%	49.55 %	29.72%
		Skill Supply	-41.60%	-28.52%	% -48.77
-1	**-0.25**	Joint	-23.11%	10.02%	-29.55%
		TOT	-4.73%	-1.35%	-1.55%
		Capital Deepening	27.89%	49.52%	29.86%
		Skill Supply	-41.64%	-28.59%	-48.93%
-1	0	Joint	-21.69%	9.85%	-27.24 %
		TOT	-4.53%	-1.20%	-1.71%
		Capital Deepening	24.68%	45.00%	25.81%
		Skill Supply	-38.51%	-25.84%	-44.81%
-1	-1.5	Joint	-27.14%	11.47%	-36.78%
		TOT	-5.22%	-1.81%	-0.75%
		Capital Deepening	38.00%	67.16%	44.76%
		Skill Supply	-49.46%	-36.02%	-59.06%
Inelastic labor supply		Joint	-18.72%	23.96%	-18.87%
		TOT	-5.39%	-1.63%	-2.28%
		Capital Deepening	25.72%	60.46%	33.58%
		Skill Supply	-36.45%	-25.33%	-42.90%

7. Conclusion

To be completed...

Appendix 1. – Sectoral Aggregation and Grouping

4-Sector SAM	Disaggregated Sectors
Unskilled Goods (GU)	Products of agriculture, hunting, forestry and fishing
	Mining and quarrying
	Food, beverages and tobacco
	Textiles, apparel, leather and footwear
	Wood and products of wood
	Other non-metallic mineral
	Basic metals and metal products
	Transport equipment
	Furniture
	Secondary raw materials
Skilled Goods (GS)	Pulp, paper, printing and publishing
	Coke, refined petroleum and nuclear fuel
	Chemicals and chemical
	Rubber and plastics
	Machinery and equipment, nec
	Office machinery and equipment
	Electrical, communication and optical equipment
Unskilled Service (SU)	Electricity, gas and water supply
	Construction
	Sale, maintenance and repair of motor vehicles; retail sale of fuel
	Wholesale trade and commission trade
	Retail trade, repair of household goods
	Hotels and restaurants
	Transport and storage
	Post and telecommunications
Skilled Service (SS)	Financial intermediation and insurance
	Real estate activities
	Renting of machinery and equipment
	Computer, R&D and other business activities
	Public admin and defense; compulsory social security
	Education service
	Health and social work services
	Recreational service

Appendix 2.– Calibrated Parameters

Table A1. Preferences Parameters - Skilled (θ^s), Unskilled (θ^u) and Government (θ^g)

	Estonia			Latvia			Lithuania		
	Skilled	Unskilled	Gov't	Skilled	Unskilled	Gov't	Skilled	Unskilled	Gov't
GU	0.560	0.716	0.013	0.639	0.728	0.017	0.551	0.704	0
GS	0.057	0.039	0.022	0.024	0.013	0	0.111	0.080	0.059
SU	0.030	0.031	0.057	0.110	0.075	0.038	0.053	0.033	0.017
SS	0.142	0.086	0.907	0.106	0.061	0.945	0.093	0.046	0.924
Investment good	0.199	0.121		0.096	0.099		0.120	0.085	
Gov't bond	0.011	0.007		0.024	0.025		0.073	0.052	
Leisure $(1-\gamma)$	0.704	0.596		0.539	0.812		0.659	0.560	

Table A2. Domestic Goods Firm Parameters

	Estonia				Latvia				Lithuania			
	α	β	μ	λ	α	β	μ	λ	α	β	μ	λ
GU	0.231	15.963	0.186	0.448	0.287	11.422	0.483	0.424	0.454	11.366	0.353	0.421
GS	0.268	22.402	0.206	0.483	0.321	18.498	0.449	0.468	0.406	21.342	0.207	0.438
SU	0.256	9.573	0.109	0.556	0.342	8.909	0.300	0.550	0.474	7.323	0.173	0.528
SS	0.307	5.872	0.097	0.676	0.355	5.699	0.190	0.654	0.435	5.127	0.067	0.651

Table A3. Final Goods Firm Parameters

	Estonia		Latvia		Lithuania	
	ϕ	δ	ϕ	δ	ϕ	δ
GU	1.951	0.548	1.982	0.547	1.990	0.537
GS	2.000	0.500	2.010	0.497	2.003	0.506
SU	1.764	0.619	1.771	0.617	1.702	0.640
SS	1.814	0.602	1.744	0.626	1.661	0.655

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