

En del av ramprojektet
"Vad kan staten göra för
att underlätta kunskaps-
intensiva industriers
attraktion av internationell
kompetens?"

PM 2018:07

The effects of immigration on economic growth – a literature study

IMMIGRATION HAS positive effects on productivity and economic growth. However, highly educated immigrants tend to contribute more to these effects. The literature suggests that immigrants boost Sweden's performance in international trade but that Sweden may lose out on some of the positive effects of immigration on innovation. In order for Sweden to remain attractive to foreign experts it might be necessary to reassess the Swedish tax relief for this group.

Dnr: 2017/100

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Förord

Detta pm är en delstudie inom Tillväxtanalys ramprojekt *Vad kan staten göra för att underlätta kunskapsintensiva industriers attraktion av internationell kompetens?* som pågår 2017–18. Den här frågan lyfts fram i regeringens exportstrategi och nyindustrialiseringsstrategi, samt av näringslivsföreträdare.

Sverige har idag ett migrationssystem som inte är särskilt inriktat på högkvalificerad arbetskraftsinvandring. För att kunna motivera eventuella förändringar i systemet är det viktigt att förstå de ekonomiska effekterna av immigration samt om det finns områden där det saknas kunskap om effekterna.

Syftet med den här rapporten är därför att sammanställa den akademiska litteraturen kring effekter av immigration på innovation, produktivitet, internationell handel och tillväxt. Studien fokuserar primärt på studier baserade på svenska eller nordiska data.

Litteraturgenomgången visar att migration överlag har positiva effekter på tillväxt, produktivitet, innovation och handel. De positiva effekterna kommer dock framför allt från högutbildade immigranter. Vad gäller innovation och produktivitet finns det relativt få akademiska studier baserade på svenska data. Vad gäller svensk internationell handel finns det däremot väl underbyggd evidens för de positiva effekter som migrationen för med sig.

Litteraturstudien har skrivits av forskarna Olof Ejermo och Claudio Fassio vid Lunds universitet. Carl Wadell har varit Tillväxtanalys projektledare och Henrik Emilsson, Anne Kolmodin och Carly Smith-Jönsson, även de på Tillväxtanalys, har bidragit med synpunkter på rapporten.

Östersund, april 2018

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Foreword

This paper is a part of Growth Analysis' framework project being carried out during 2017–18, *What can the state do to facilitate knowledge intensive industries' attraction of international talent?* This issue is addressed in the Swedish government's Export Strategy and Smart Industry – a strategy for new industrialization of Sweden, as well as by industry representatives.

Today the Swedish migration system does not specifically target highly skilled immigrants. To determine whether changes to the system are motivated it is important to first understand the economic effects of this type of immigration, and if there are any areas where there is a lack of knowledge regarding these effects.

The aim of this report is therefore to summarize the academic literature on the effects of immigration on innovation, productivity, trade, and economic growth. The literature review focuses primarily on empirical studies based on Swedish and Nordic data.

The literature on the effects of immigrants on economic growth, productivity, innovation, and trade is generally positive. One conclusion from the literature review is that most of these positive effects come from highly skilled immigrants. Concerning innovation and productivity, fairly little research exists with respect to the case of Sweden, and clearly much more could be done. Conversely, there is already well-grounded evidence on the positive impact of immigrants on Swedish firms' performance in international trade.

The literature review is written by Assoc. professor Olof Ejermo and Dr. Claudio Fassio who are researchers at Lund University. Carl Wadell has been the project manager at Growth Analysis and Henrik Emilsson, Anne Kolmodin, and Carly Smith-Jönsson, also Growth Analysis, have contributed with feedback on the paper.

Östersund, April 2018

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Sammanfattning

Denna litteraturstudie undersöker aktuell akademisk forskning kring effekterna av migration på tillväxt, produktivitet, innovation och handel.

Utbildade immigranter har positiv inverkan på tillväxten

Den empiriska litteraturen om migration och tillväxt visar tydliga positiva samband mellan dessa variabler. Samtidigt är många av dessa studier på en aggregerad nivå vilket innebär att de säger lite om vilka underliggande mekanismer det är som skapar detta samband. Det finns dock viss evidens att personer med hög utbildning i stor utsträckning bidrar till denna effekt. I Sverige uppskattas migrationen haft en större positiv tillväxteffekt än många andra OECD-länder under perioden 1986–2006. Förklaringen är att utbildningsnivån har varit relativt hög bland de immigranter som kom till Sverige under den här perioden. Även på senare år har utbildningsnivån varit hög bland de som immigrerat till Sverige. Samtidigt har gruppen immigranter med okänd utbildningsbakgrund vuxit vilket gör det svårt att förutsäga effekterna på tillväxten.

Sverige kan gå miste om immigrationens positiva effekter på innovation

Vad avser produktivitet finns det en rad studier som undersöker hur mångfald påverkar prestationen på regional nivå. Återigen, i de flesta fallen visar litteraturen på positiva produktivitetseffekter. En intressant observation från Danmark och USA är att den lokala ortsbefolkningen tenderar att ta mer kvalificerade arbeten när immigrationen ökar. Samtidigt skiljer sig den danska arbetsmarknaden från den svenska med sitt *flexicurity*-system som ger en högre flexibilitet när det kommer till att anställda och avskeda arbetskraft. Det här medför att resultaten inte nödvändigtvis är generaliserbara för den svenska arbetsmarknaden.

Flera artiklar diskuterar också hur migration påverkar innovation, vilket ofta mäts med hjälp av patent. Flera av dessa studier visar att om etnisk och kulturell mångfald stiger så har (utbildade) immigranter en positiv inverkan på det regionala innovationsresultatet. Samtidigt saknas den här typen av regionala studier för de nordiska länderna. Istället finns det studier på företagsnivå. Här finns det en svensk studie som visar att mångfald har en positiv effekt på radikal innovation (nya för marknaden) men inte på mer inkrementell innovation. Vissa studier tittar på hur immigrationens effekter på innovation inom särskilda sektorer, med blandade resultat. En orsak kan vara att sammansättningen av migranter samt den teknologiska nivån är olika för olika sektorer. En studie som utgår från företags patenteringsmönster i Frankrike, Tyskland och Storbritannien visar på positiva effekter i högteknologiska sektorer och från immigranter med hög utbildningsnivå.

Ett stort antal studier analyserar effekterna av immigration med hjälp av individdata. Ett vanligt angreppssätt är att studera vilka som står med på patent och som därmed varit direkt involverade i innovationsarbetet. I USA har immigrationen av uppfinnare till landet haft långsiktigt positiva effekter på patentering. I Europa tenderar norra Europa att vara den främsta destinationen för uppfinnare. Samtidigt visar en stor svensk studie att immigranter inte bidrar i någon överväldigande omfattning till patentering. Immigranter är istället något underrepresenterade bland uppfinnare som tar patent och även andra generationens invandrare presterar något sämre än de som har föräldrar som är födda i Sverige. Det här resultatet är något överraskande eftersom immigranter ofta är över-

representerade bland teknikerbetare i västvärlden (i synnerhet i USA). I ljuset av att Sverige har förhållandevis många multinationella företag skulle det motsatta resultatet kanske varit mer väntat. Samtidigt har svensk migrationslagstiftning efter 1975 (och till nyligen) inte varit särskilt inriktad på att attrahera högkvalificerad arbetskraft.

Immigranter förbättrar Sveriges prestation inom internationell handel

Enligt litteraturen kan immigranter bidra till internationell handel på två sätt, dels som konsumenter av produkter från andra länder eller som anställda vid företag som bedriver internationell handel. I rollen som konsumenter, visar litteraturen att effekterna på import till följd av konsumenternas särskilda preferenser för produkter från hemlandet, är mindre bland immigrantgrupper i de nordiska länderna jämfört med USA och andra länder. Däremot finns det ett positivt samband mellan närvaron av svenska och danska grupper av emigranter och exporten från hemlandet till landet där de bor. I den här litteraturen särskiljs inte låg respektive högkvalificerad arbetskraft. Litteraturen som studerar effekterna av migranter som anställda visar att företagen där de anställs börjar göra mer affärer med länderna som migranterna kommer ifrån, vilket är i linje med intuitionen att migranternas kunskap om deras hemland bidrar till att etablera handelsnätverk. Studier på svensk mikrodata visar att utbildade immigranter som anställs i svenska företag är mest effektiva när det kommer till att förbättra exporten. I de flesta fall visar forskningen endast på positiva effekter på exporten till immigranternas hemländer. Nyligen publicerad forskning visar dock att, genom att öka företags produktivitet, har immigranter i franska företag kunnat förbättra exporten överlag (inte bara till sina hemländer). En annan studie från Danmark pekar på att mångfald i arbetsstyrkan gör det möjligt för företag att förbättra sin generella förmåga att hantera olika kulturer, normer och institutioner och på så sätt förbättra sina exportresultat.

Resultaten indikerar att det är möjligt att dela upp inverkan av immigrerade anställda på företags internationella handel i två kategorier. Den första innebär minskade kostnader för att bedriva handel och härrör från ursprungsspecifika kunskaper som (främst kvalificerade) immigrerade anställda tar med till sina företag. Detta kan betecknas som en ”kostnadsbaserad strategi”. En anledning till att företag anställer immigranter kan vara att det ger tillgång till relevant kunskap om utländska marknader till ett relativt lågt pris. Som befintliga studier visar, kan denna kunskap även föras in i företagen genom att anställa chefer med viss försäljningserfarenhet på specifika utländska marknader. Detta kan dock vara en mindre kostnadseffektiv strategi. Att anställa en immigrant för att öka företagets export till ett visst land är därför särskilt väl lämpat för företag med begränsade ekonomiska och organisatoriska resurser (små företag med relativt låg produktion). Den andra kanalen, som bygger på ovan nämnda evidens från Danmark, tyder på att kompetenta migranter kan påverka handeln på ett annat sätt: genom att bidra till en mer global kultur hos de anställda, till följd av etniskt mångfald. Att ha arbetskraft, och särskilt en ledningsgrupp, med en heterogen och kulturellt diversifierad inriktning kan starkt underlätta företagets internationalisering. I detta avseende kan kvalificerade migranter påverka företagets exportresultat, inte genom låga kostnader, utan snarare som en ”kulturfaktor” som annars inte kan förvärfvas på marknaden och som skulle kunna ge företagen en mycket konkurrenskraftig tillgång för sin internationella verksamhet. Sammantaget tyder detta på att företagets strategier bör ha en central roll i analyser som syftar till att förstå migrationens inverkan på handeln, särskilt när det gäller kvalificerad migration eftersom företagen inte bara är passivt mottagare av utländsk arbetskraft utan aktivt söker personer med kompetenser som kan användas för att få tillgång till internationella marknader.

Brist på utvärderingar av den svenska expertskatten

Med avseende på policy är det möjligt att skilja mellan studier som analyserar skatter i stort och skattesystem riktade till utländska kvalificerade arbetstagare, studier som tittar på effekterna av olika viseringspolitik (främst USA-baserad litteratur) och andra som har fokuserat på inverkan av den europeiska integrationen. När det gäller skattenivåer har en studie visat att mobila och motiverade individer är känsliga för skillnader mellan skattenivåerna i olika länder. Detta illustreras av de positiva effekter stora marginella skattesänkningar i Danmark (början av 1990-talet) och USA (tidigt 1980-talet) hade på migrationen av uppfinnare.

När det gäller skattesystem introducerades expertskatt i Danmark 1992 och, en något annorlunda version, i Sverige 2001. I Danmarks fall finns det evidens att subventionen attraherat kvalificerade utländska arbetstagare och att den medfört en positiv effekt på produktiviteten hos de företag som anställde dessa, möjligen på grund av dess regelbaserade och enkla konstruktion. För Sverige saknas akademiska studier om detta, men införandet av expertskatt verkar ha haft mindre effekt än i Danmark. Detta kan bero på att det initialt var komplicerat att ansöka om expertskatt och att det i och med 2012 års ändring sattes ett högt inkomstkrav vilket gör att få experter kvalificerar sig.

Bevis på den fria arbetsmarknaden som uppkommit genom den europeiska integrationen visar blandade resultat för de europeiska länderna. I överensstämmelse med den komprimerade inkomststrukturen och Sveriges progressiva skattesystem var en kortsiktig effekt av den europeiska integrationen att andelen lågutbildade immigranter ökade på 1990-talet.

Sammanfattningsvis

Sammantaget visar litteraturgenomgången att immigration överlag har positiva effekter på tillväxt, produktivitet, innovation och handel. Vad gäller innovation och produktivitet finns det relativt få akademiska studier baserade på svenska data. Mer skulle kunna göras inom dessa områden. Vad gäller svensk internationell handel finns det däremot väl underbyggd evidens för de positiva effekter som migrationen för med sig. En slutsats från den här litteraturstudien är dock att de positiva effekterna framför allt kommer från högutbildade immigranter. I jämförelse med andra länder (i synnerhet anglosaxiska länder som USA och Storbritannien) har Sverige inte varit lika inriktat på att attrahera högkvalificerad arbetskraft. Det kan även vara så att det svenska skattesystemet har haft en negativ inverkan på möjligheterna att attrahera personer med hög utbildningsnivå. I det här avseendet tenderar den svenska expertskatten att ha varit ett steg i rätt riktning. Samtidigt kan denna skatte-subvention behöva ses över för att Sverige även fortsättningsvis ska kunna attrahera högkvalificerad arbetskraft.

Summary

This literature review investigates current academic literature regarding the effects of immigration on economic growth, productivity, innovation, and trade.

Skilled migration has positive effects on economic growth

The empirical literature on immigration and economic growth clearly indicates positive effects from immigration. However, because of the aggregated level of analysis in these studies they reveal little about the underlying mechanisms by which growth effects operate. Some evidence indicates that more highly educated immigrants contribute significantly more to economic growth. Immigration's effects on growth in Sweden are estimated to have been higher than in many other OECD countries during the period 1986–2006, due to high education levels among immigrants. Although the reported education level of immigrants has remained high, in recent years a much larger share of the total number of immigrants has had an unknown or unreported education level. This contributes to uncertainty concerning the extent of future growth effects.

Sweden may lose out on immigration's positive effects on innovation

With regards to productivity, many studies have investigated the impact of diversity on regional performance. Again, this literature reports positive effects on productivity in most cases. Notably for Denmark and the United States, a detailed finding is that local natives tend to move to more qualified jobs in response to increased immigration. However, while geographically close to Sweden, the Danish labor market works differently than the Swedish, with a higher flexibility in terms of hiring and firing characterizing its special “flexicurity” system. This means that results may not be easily generalizable to the Swedish situation.

There are also many empirical studies on the effects of immigration on innovation, typically measured using patent data. These studies have often shown that, by increasing the overall level of ethnic or cultural diversity, (skilled) immigrants contribute positively to innovation performance within *regions*.¹ However, empirical evidence at the regional level is lacking for the Nordic countries. On the other hand, we do find evidence at the *firm* level. Here, a study on Sweden finds positive effects on new-to-market (radical) innovations, rather than more incremental innovation. A couple of studies look at effects of immigration on innovation using the *sector* or branch as the level of analysis, with mixed evidence. A plausible reason is that the composition of immigrants and the technology level varies by sector. In one study using data on firm patenting in France, Germany and the UK, positive effects are found in high-tech sectors and from highly educated immigrants.

A large range of studies analyze the impact of immigration on innovation using data at the *individual* level. Typically, these studies look at inventors named on patent records, i.e. at the individuals who are directly involved in the development of innovations. In the US, there is evidence that immigration of inventors has long-term positive effects on inventive activity. With regards to Europe, Northern European countries seem to be the main

¹ The term *skilled* migrant is generally used in the literature to refer to migrants with a certain level of competence or occupation. However, data on “skills” is usually missing and therefore most studies use education data to proxy for skills.

destination for inventors. However, the contribution of foreign inventors to inventive activity seems not to be as significant as in the US. The only large-scale study on this subject conducted in Sweden finds that immigrants are somewhat underrepresented among inventors, and that second-generation immigrants patent less than people with Swedish-born parents. This result is somewhat surprising, as in many developed countries (in particular, the US) immigrants tend to be overrepresented among workers in technology fields. Moreover, given the high level of internationalization of the Swedish economy, not least through its many multinational firms, the opposite pattern might have been expected. On the other hand, Swedish immigration policy since 1975 has not specifically targeted high-skilled immigrants.

Immigrants boost Sweden's performance in international trade

The literature discusses two main mechanisms by which immigrants can contribute to trade – as consumers of foreign products or as employees of companies that engage in international trade. Some empirical research on immigrants, in their role as consumers, focuses on effects on imports, due to preferences for products from their countries of origin. This import effect has been found to be less strong for immigrant communities in the Nordic countries than in the US and other countries. There is, instead, evidence of a positive association between the presence of *emigrant* communities from Sweden and Denmark and the level of exports from the country of origin to the foreign country in which these communities are based. It must be stressed that, in the literature regarding the trade effects of immigrants as consumers, there is not a strong distinction between the effect of high-skilled and low-skilled immigrants.

The literature that analyses the effects of immigrants as employees shows that the firms where they are employed start to trade more with their countries of origin. This is in line with the intuition that immigrants' knowledge of their home countries helps to facilitate trade networks. Studies using Swedish data have found that skilled immigrant employees are effective in boosting export performance. The impact of immigrants on exports is usually only found to affect exports to their specific countries of origin. However, recent studies have shown that, by boosting the productivity of firms, skilled immigrants have allowed French firms to increase their productivity and, hence, boost exports in general (not only to specific destinations). Another study from Denmark suggests that a diverse (skilled) workforce allows Danish firms to increase their general ability to manage different cultures, norms, and institutions, and hence improve their export performance to different countries simultaneously.

Our review indicates that it is possible to divide the impact of immigrant employees on companies' trade performance in two broad categories. The first involves a decreased cost of trade that arises from countries of origin-specific knowledge that (mainly skilled) immigrant employees bring to their firms. This can be labelled a "cost-based strategy". A reason why firms hire immigrants could be that it provides access to relevant knowledge about foreign markets at a relatively low price. As shown by existing studies, this knowledge could also be accessed by firms through the hiring of managers with sales experience in specific foreign markets. However that may be a more expensive strategy. Hence, hiring an immigrant to boost a firm's exports to a specific country is a strategy that is particularly well suited for firms with limited financial and organizational resources (small or relatively low-productive firms).

The second channel suggests that skilled immigration can affect trade in another way: allowing for a more “global mindset” among its workforce as a result of ethnic diversity. Having a workforce, and especially a management team, with a heterogeneous and culturally unbiased mindset can strongly facilitate the international performance of companies. In this respect, skilled immigration would affect a firm’s performance, not through the cost channel, but rather as an additional factor that cannot otherwise be accessed on the market, and which might provide firms with a very competitive asset for their international activities. Altogether, this suggests that firms’ strategies should have a central role in analyses that aim to understand the impact of immigration on trade, especially where skilled migration is concerned. Firms are not simply passive recipients of a foreign workforce, but actively seek individuals with competencies that can be used to access international markets.

Lack of evaluations targeting the effects of the Swedish foreign expert tax

With respect to policy, it is possible to differentiate between studies that analyze taxes broadly, and tax schemes aimed at foreign skilled workers, studies that look at the impact of different visa policies (mainly US-based literature), and others that have focused on the impact of European integration. Concerning tax level, one study has found that mobile and highly motivated individuals are sensitive to international differences in taxes, and the effects of such are illustrated by the positive effects of large marginal tax cuts in Denmark (early 1990s) and the United States (early 1980s) on inventor immigration. With regards to tax schemes, a foreign expert tax subsidy was introduced in Denmark in 1992 and a different version in Sweden in 2001. For Denmark, the evidence suggests that the subsidy attracted qualified foreign workers, and it led to a positive effect on the productivity of the firms who hired them, possibly because of its rule-based, simple-to-understand construction. For Sweden, no proper academic studies on the subsidy exist, not least because of the lack of data, but its impact seems to have been lower. This could be because applying for it was initially complicated, and the 2012 amendment requires too high of an income to be accessible by large numbers of experts. Evidence on the free labor market brought about by European integration shows mixed results for European countries. Consistent with the compressed income structure and Sweden’s progressive tax system, a short-term effect of European integration was an increase in the share of low-skilled immigrants in the 1990s.

In summary

Summing up, the literature on the effects of immigrants on economic growth, productivity, innovation, and trade is generally positive. Concerning innovation and productivity, fairly little research exists with respect to the case of Sweden, and clearly much more could be done. Conversely, there is already well-grounded evidence on the positive impact of immigrants on Swedish firms’ trade performance. One conclusion from the literature review is that most of these positive effects come from highly educated immigrants. Compared to other countries (especially Anglo-Saxon countries like the US or the UK), Sweden has not been targeting the highly educated. It must also be stressed that the tax system may have a negative impact on the possibility to attract individuals at the upper end of the skill distribution scale. In this respect, the Swedish tax incentive scheme for “foreign experts” may be a move in the right direction. However, in order for Sweden to remain attractive to foreign experts it might be necessary to reassess the design of this tax incentive.

1 Introduction

This review was commissioned by the Swedish Agency for Growth Policy Analysis (Myndigheten för tillväxtpolitiska utvärderingar och analyser, “Tillväxtanalys”) and aims to investigate the current academic literature regarding the effects of immigration on economic growth, productivity, innovation, and trade.² We mainly focus on the immigration of highly skilled individuals.

1.1 Methodology

The first step of the methodology that was used for this review consisted of a literature search on Google Scholar and Web of Science.³ We also scouted the webpages of several scholars in the field, with an emphasis on Swedish researchers. Our review is, however, not a complete coverage of the literature on these issues. We made an informed choice of what material to include, excluding articles that were clearly substandard or off-topic. We also aimed to highlight the existing evidence on countries in Northern Europe, in particular on Sweden, hence avoiding an overly US-centric perspective. We also excluded studies that were either considered outdated or that were based on old data, as this review is mainly based on the recent empirical material. For this reason, we also excluded some highly theoretical papers. In spite of these restrictions, a total of 112 studies were deemed sufficiently relevant to be included in the review. Finally, the review reflects our disciplinary backgrounds, such that we sample more heavily in fields more closely related to economics.

Clearly, an important methodological issue is what is to be considered “an effect” of immigration. In economics, a prominent place is given to discussions of cause and effect as opposed to correlations. Concerning immigration, it is apparent that the choice of moving is often related to a person’s ability to take advantage of the move. This is referred to as “selection into immigration”. Thus, it may well be that the initial decision to move is triggered by higher ability (and high skills), or higher motivation and ambition, and thus an “effect” could result more from initial self-selection rather than the act of immigration itself. Another problem is related to the fact that immigrants are attracted by regions and cities with strong economic growth, since that is where most job opportunities are: this means that sometimes it can be difficult to understand whether it is the arrival of new immigrants that determines such economic performance or whether it is the other way around.

To uncover a causal effect of immigration, empirical economists adopt a battery of different methods. The most important in this area of literature is a statistical technique called instrumental variables (IV). This method attempts to find a variable that induces immigrants to move to a geographical destination, but that is unrelated to the economic (and innovative) performance of the destination (except through the immigration itself). One such variable that is frequently used is the already established presence of immigrants

² Doc. Olof Ejermo wrote the chapters concerning growth, productivity, and innovation, and Dr. Claudio Fassinio wrote the chapter about immigration and trade.

³ The following keywords were used: “Immigration innovation”; “Immigration R&D”; “Immigration research and development”; “immigration Sweden innovation”; “immigration inventors”; “immigration patenting”; “immigration inventive”; “Immigration productivity”; “immigration Sweden growth”; “immigration Sweden entrepreneurship”; “immigration growth”; “export/import/trade+ immigration” and “export/import/trade+ immigration+Sweden/Norway, Denmark/Finland”.

of a certain ethnicity, which then triggers follow-on migration (Card 2001). In existing studies, this variable proved to be very effective for the migration of low-skilled individuals, allowing for the identification of real causal effects of immigration. While there are reasons to believe that this might also work for skilled immigrants, as the presence of co-nationals still allows for higher awareness of job opportunities within the ethnic community, the variable's explanatory power might be lower. The increasing evidence of individuals aiming for international (or global) careers suggests that for skilled managers or professionals the presence of an already existing ethnic community in the host country might matter less. These individuals might instead be attracted by specific job opportunities that are well matched to their specific skills. Another issue in the literature concerns the measurement of diversity that is usually used in this context to denote a mix of different nationalities in, e.g., a region. The presence of a diverse workforce could stimulate idea development and hence be a channel for innovation. Diversity is, however, used differently and measured differently by different authors (e.g. Theil index, Hirschmann-Herfindahl, etc).

It is also important to acknowledge the role of firms in shaping mobility patterns: while in some cases international mobility is the result of spontaneous individual decisions, in others it is the consequence of corporate human resource strategies. From a policy perspective, this is important since, if the contribution of "skilled immigrants" is an outcome of corporate strategy, then policy interventions aimed at increasing skilled immigration, if not matched to a corresponding level of demand by firms, may prove ineffective.

2 A positive effect on productivity and economic growth, mediated by education level

This section reviews the literature of immigration and growth effects, as well as on the related but still distinct concept of productivity. The growth effects concern Gross Domestic Product, i.e. the value added that is used as wages and gross return to capital. Productivity, on the other hand, concerns the value of the whole production of firms, i.e. usually sales value. Under this section are also included studies on wages, which are normally viewed in economics as a relevant indicator of individuals' productivity. Also, one study on occupational change of the native workforce is discussed. This is relevant, as any occupational upgrading most likely reflects a sharper division of labor that should be associated with productivity gains, according to classic economic theory.

2.1 Growth effects

In a study of 22 OECD countries 1987–2009, Boubtane et al. (2013) use panel vector autoregressions (VAR) to uncover a positive relationship from immigration on GDP per capita and a negative relationship on aggregate unemployment. Immigration levels are influenced by host country economic conditions. In a related paper, Boubtane et al. (2016) find that migrants' human capital has a positive impact on GDP per capita and that a permanent increase in migration leads to a positive impact on GDP per worker. Twenty-two OECD countries are examined. Interestingly, the positive GDP effects are not confined to countries with selective migration policies. The paper also provides comparable statistics on the education level of immigrants in different countries measured as the share of immigrants with tertiary education. The average education level of immigrants in Sweden exceeded that of other OECD countries in 1986–2006, with an average of 37 per cent with tertiary education. The OECD average for the same time period was 29 per cent. Based on the regression results, the study predicts that if Sweden were to increase its immigration rate by 50 per cent, it would raise its short-term GDP per worker by 0.22 per cent and by 1.56 per cent in the long run. However, education level data from Sweden are uncertain.⁴

Docquier et al. (2015) try to quantify the effects on GDP of a complete liberalization of cross-border migration worldwide. The level of potential migration is estimated to be approximately 400 million. World GDP is estimated to increase by about 12 per cent in the medium term, with a lower estimate of 7 per cent if schooling externalities are taken into account and an upper estimate of 18 per cent if network effects are included. A very "econometric" approach is taken in an earlier study by Morley (2006), who tests the direction of causality between economic growth and immigration using a cointegration approach. He finds evidence that growth induces more immigration, but not the opposite. Felbermayr et al. (2010) find a clear and robust positive effect of immigration on real per capita income for a large sample of countries. With regards to underlying mechanisms, Bove and Elia (2017) suggest that it is through the introduction of diversity that immigra-

⁴ According to Flood and Ruist (2015, Figure 3.7, p. 31), the education level of 30 per cent of immigrants in 2012–14 was unknown, and was unknown for close to 10 per cent of all immigrants, i.e., also before 2012. Of those with recorded education levels, the share of both highly educated (more than three years at the university level) and lowly educated (less than upper secondary high school "gymnasium") is higher for the entire group of immigrants. Similar patterns are shown among recent immigrants (2012–14), where recorded data exist.

tion contributes to economic growth, because immigrants carry new skills and perspectives, although social cohesion may decrease and create communication barriers. They find no evidence that increased diversity eventually comes with increased communication barriers (i.e., for high levels of diversity). Hence, increased diversity seems positively linked with economic growth. This effect is more consistent for developing countries.

The European Union has the ambition to create a common labor market for its inhabitants, allowing for the free mobility for work purposes between member states and European Free Trade Area (EFTA) countries. In recent years, eastern European countries have joined this union, greatly changing the flows of migrants for work purposes across Europe, especially to the United Kingdom and the Republic of Ireland. Still, in practice, administrative and linguistic borders exist, suggesting that it will take a long time to reach “free” mobility in, e.g., the way we see in the United States. Thus, Europe is only at the beginning in its realization of an integrated labor market. Boeri et al. (2005) estimate that an increased migration amounting to 3 per cent of the Eastern European population to Western Europe would increase total EU GDP by 0.5 per cent. A more recent study on EU27 regions by Huber and Tondl (2012) examines the effects of immigration on unemployment and GDP in EU27 NUTS2 regions 2000–2007. They also find positive GDP per capita effects, without increased rates of unemployment. However, an increase in immigration by 1 per cent is associated with just 0.02 per cent higher GDP and 0.03 per cent higher productivity, although the long-run effects are higher and estimated at about 0.44 per cent for GDP and 0.20 per cent for productivity. Regions with high emigration seem to suffer from similar reductions. The authors conclude that immigration does not promote convergence among EU countries.

2.2 Effects on productivity

For the US, Ottaviano and Peri (2005, 2006) find a positive effect on wages for natives of regional diversity in language. Their results suggest that it is mainly immigrants that have stayed for longer periods of time that drive this effect. Both papers study the period 1970–1990. In another study on the US, Peri et al. (2015) examine the effects of immigrants in science, technology, engineering, and mathematics (STEM) on city productivity as measured by wages, 1990–2010. They find that increases in the number of foreign STEM workers are associated with significant wage gains for college-educated natives, but more modest gains, though still significant, for the non-college educated.

Several papers discuss the experience of Denmark, but, to our knowledge, none discuss Sweden. Schmidt and Sandholt Jensen (2013) examine the effect of foreign labor on regional growth. They discuss two main channels through which immigration affects labor demand. On the one hand, immigration could lead to the substitution of workers. If foreign labor can compete with lower wages, then it could crowd out the native labor force. On the other hand, it could lead to a scale effect through which immigrants might increase productivity, which raises the demand for labor. Such productivity effects may arise from human capital levels, complementarity effects or through entrepreneurship. Schmidt and Sandholt Jensen (2013) cannot discern negative effects from immigration on job opportunities for Danish workers, but find mixed evidence on wages. On the other hand, job opportunities are not static. Immigration can be expected to lead to a different division of labor, where immigrants take jobs that require less language and interaction skills, and natives take work that requires more communication and often represents jobs of “higher qualification”. Foged and Peri (2016) find that immigration had an effect on low-skilled natives, who pursued less manual work and increased these natives’ wages, employment,

and occupational mobility. Peri and Sparber (2011) conducted a similar study in the US that focused, however, on occupational change among native high-skilled workers. The article reveals that immigrants specialize in occupations demanding quantitative and analytical skills, whereas their native-born counterparts specialize in occupations requiring interactive and communication skills. When immigrants enter an occupation, a division of labor takes place in which the native-born move out of sub-occupations requiring analytical competence to sub-occupations focusing on communication skills.

Parrotta et al. (2014a) use Danish firm data to calculate how diversity affects so-called total factor productivity (TFP), an indicator often used to measure technical change. They find a negative association between ethnic diversity and TFP, but education diversity has mixed effects. Trax et al. (2015) distinguish between diversity in an establishment's workforce and that of a region. Using German data, they find that diversity, measured as the share of foreign workers, has no effects – neither on total factor productivity in the establishment nor in the region. They do, however, provide evidence of the positive effect of diversification on TFP with respect to nationality in manufacturing both at the plant level and in regional diversification. The latter effect is mainly ascribed to effects in services, in technology- or knowledge-intensive industries.

2.3 In summary

To sum up, quite a few studies emerge from the material on the growth effects of immigration, with almost all studies finding positive growth effects from immigration. Evidence suggests that the education level of immigrants might be important and that the effects may stem from greater diversity. In particular, one study finds a positive effect of immigration for Sweden. The results suggest that this is driven by the high education level of immigrants. With respect to productivity, which tends to be measured through wages (reflecting individual marginal productivity in economic theory), most studies show positive effects on productivity. Studies on Denmark and the US suggest that this is because natives can upgrade to better occupations. Clear effects are found for Denmark, which could, however, reflect the specifically Danish labor market situation, which has a highly flexible (hire and fire) labor market, and thus these results might not translate to the Swedish situation.

3 Sweden may lose out on positive effects from immigration on innovation

With respect to the effects of immigration on innovation, we distinguish between studies on four levels: regions (cities), firms, sectors, and individuals. While the majority of studies use patent data to measure innovation, quite a few also use data from the Community Innovation Survey, a large-scale survey of innovation sent every other year to firms in EU countries, but also to European, non-EU countries.

3.1 Regional and city innovation

Three articles look at regional patenting resulting from innovation, in US states, in European regions, and in German regions, specifically. Hunt and M. Gauthier-Loiselle (2010) find that immigrant college graduates apply for more patents than natives do, because they more frequently hold science and engineering degrees. Ozgen et al. (2011) look at 170 European NUTS2-level regions for the periods 1991–1995 and 2001–2005. Innovation outcome is measured as patent applications per million inhabitants. Immigrant diversity positively affects innovation above a critical minimum level, but not necessarily the level of immigration. Niebuhr (2010) uses indexes of nationalities of the regional labor force, and specifically of R&D workers, to examine the effects of cultural diversity on patent applications in 95 German regions in the late 1990s. She finds a positive effect of regional diversity on innovation.

Two papers look at the wage effects of high-skilled immigrants. Islam et al. (2017) extend the work of Hunt and M. Gauthier-Loiselle (2010) to look at the effects on wages stemming from innovation-induced immigration. They find that, in occupations where the share of skilled immigrants is greater, the wages of both immigrants and natives increase. Also, they find that wages increase more broadly in the state/region outside the skill group. Cooke and Kemeny (2017) investigate whether wages respond positively to higher immigrant diversity in US workplaces and cities in 1991–2008. They find support for this idea, but only mixed evidence for occupations characterized by high levels of problem-solving and personal interaction.

Gagliardi (2015) combines firm micro-data with that of British local labor market areas. She finds support for a causal link between skilled immigration and innovation for both product and process innovation.

3.2 Innovation on the firm level

The effects of diversity, which was a common theme at the regional level, are revisited also on the firm level. Reverse causality becomes quite troublesome, if not dealt with, as the decision to hire an immigrant may very well be linked to the firm's intended outcome, such as innovation. The reviewed papers all discuss endogeneity.

Parrotta et al. (2014b) look at the role of ethnic diversity for firm patenting in Denmark and find that ethnic diversity increases the intensive margin (the propensity to apply for patents) and the extensive margin (number of patent applications), as well as the technological breadth of patenting.

Ozgen et al. (2014) utilize comparable Dutch and German linked employer-employee data. They examine whether product innovation is affected by diversity. They find evidence in

the German case that diversity affects product innovation, but not in the Dutch case. They argue that this could be because of the use of a rather imprecise instrument for measuring diversity in the Dutch case.

Mohammadi et al. (2017) utilize Swedish employer-employee data combined with data on firm product innovation and external collaboration to examine the role of ethnic diversity. They find that ethnic diversity has a positive impact on a firm's radical, but not incremental, innovation, where radical is defined as a firm having at least one product or process innovation new to the market.

Mare et al. (2014) use data on firms from the years 2005 and 2007 in New Zealand, as well as several innovation measures, which they regress on local area measures of workforce participation, including the migrant share. While they initially find evidence of a positive effect from the share of migrants, once they account for industry effects the effect turns insignificant. One clear difference between this and the previous studies is that they use the migrant share at the regional level, rather than at the firm level.

The importance of this is well illustrated by Lee (2015), who looks at the migrant *ownership* share on the UK firm and regional level, respectively. He finds that firms with a higher migrant share tend to introduce more product and process innovations. However, the share of foreign workers on the local labor market has no effect on innovation. A major difference with the above studies, however, is that this study does not take the possibility of reverse causality into account in any way.

Additionally, Nathan and Lee (2013) use British data, specifically from London in 2005 and 2007. They report a small bonus for management-diversified London firms in terms of new product innovations. Migrant-run firms also more frequently introduce major process innovations. Ethnically diverse firms serve the large and diverse home (London) market, whereas migrant firms tend to serve international markets. A caveat is that endogeneity remains an issue, and their estimates may be upward biased.

3.3 Innovation by sector

Only two of the studies look at immigration effects by sector. Kangasniemi et al. (2012) use the sectoral level in Spain and the UK to examine the effects of immigration on productivity. In Spain, migration had a negative contribution on labor productivity growth, but it had a negligible effect in the UK. For total factor productivity, positive effects were obtained for the UK and negative for Spain.

Fassio et al. (2015) use sectoral data from France, Germany and the UK from 1994–2005 to study the effects of migrant workers on patent applications. They find that highly-educated migrant workers increase patenting, but at a lesser rate than natives do. The effect is stronger for high-tech sectors. Low-skilled migrants have, on the other hand, a negative effect. European migrants have a stronger impact than those of third-world countries.

3.4 Immigrants and innovation

In recent years – thanks to the increased availability of employer-employee data and “big data” from patents and publication databases – we find an increasing range of studies on the role of individual immigrants. A large share of the literature explores US data, with much fewer European studies. We look at the effects mainly on science and patenting that are discussed in these studies.

Studies on the US discuss several aspects of immigration, including student intake, contributions to science and technology, and entrepreneurship. The US, however, has a much more selective set of immigration policies in place, emphasizing immigration for work, rather than refugee immigration. It is clear from existing studies that the effects that immigration has on science and innovation in the US are pervasive. Channels that have been studied include the effects of international student intake on patenting (Chellaraj et al. 2008), of doctoral students on scientific production (Stuenkel et al. 2012), of immigrants' impact through faculty (Stephan and Levin 2001), and of effects on entrepreneurship (Kahn et al. 2017), all pointing to the positive effects of immigration. An important instrument in the US case seems to have been special visas issued for specialized labor (H1-B visas), which is heavily discussed in the literature (see the policy section below).

Another body of literature that started with US data concerns the role of ethnic communities, rather than isolated immigrants, and their role in technology development and innovation. Kerr (2008) attempts to understand how ethnic communities⁵ in the US contribute to patenting and how they establish links with their home economies. Many ethnic communities play this role, but Chinese ethnic links are identified as being very important in this regard, especially in high-tech industries. Moreover, ethnic links also increase manufacturing output in home countries. Akcigit et al. (2017) find that immigration has had long-term impacts on US innovation. Geographical areas that were technological strongholds of foreign inventors in the period of 1880–1940 saw more patenting and citations than 1940–2000. Douglas (2015) finds a robust statistical association exists between the rate of immigration to the US and the level of patent citations to the origin country. In this way, immigration leads not only to “brain drains” but also to reverse knowledge flows, potentially with a gain for both sending and receiving countries.

Related to the study by Douglas (2015) is Oettl and Agrawal (2008), but the latter use an international dataset on inventors and their respective firms and citations to understand the effects of international migration on technology flows. They find that mobility to new firms increases citation gains, not just to the firm, but also the receiving country. In addition, knowledge flows (again measured by citations) increase to firms in origin countries. This backflow effect is twice as strong if the firm is multinational.

For Europe, Miguélez et al. (2010) look at descriptive patterns of inventor mobility between NUTS2 regions. They find that Swedish regions, along with other regions in northern and central Europe (e.g. Austria, Germany, Switzerland, the Netherlands, and Finland), benefit especially from inflows of inventors in relation to their stock of tertiary educated. A study that looks specifically at immigrants in the Swedish workforce is that of Zheng and Ejermo (2015), which examines the role of immigrants for Swedish inventive activity using employer-employee linked inventor data from the European Patent Office. They find that immigrants contribute statistically significantly less to inventive activity than Swedish-born citizens, although the difference is small in an absolute sense. This picture is clearly different from Miguélez et al. This could be because the regional distribution of immigration and its inventive effects are distinctively different for different Swedish regions and/or because the data were collected in a different manner: Miguélez et al. assign inventors to country of origin based on probabilistic name-matching techniques, whereas Zheng and Ejermo use data linked to address records of individuals to (arguably

⁵ Several additional papers exist on ethnic communities, ‘diasporas’, and innovation diffusion, with a US-centric perspective with less relevance for the current review. For an overview, see Lissoni (2017).

more precisely) identify them. Zheng and Ejermo also find that the quality of the patents of immigrants is not lower than that of natives. In addition, immigrants who came to Sweden as children were found to contribute less to inventive activity, both in terms of quantity and quality. The authors argue that Swedish immigration policy, together with a compressed wage structure, has led to less favorable selection of immigrants. Yet again, immigrants have, according to the study earlier referred to by Boubtane et al. (2016), a high education level in Sweden. However, even though immigrants are highly educated (and therefore more likely to be inventors), they may have a lower labor market attachment or possibly the wrong skill set for inventing. Thus, their unexpectedly low contribution could be attributed to a lack of matching positions available on the labor market. Moreover, in contrast to the US, Swedish citizens continue to enter education programs in science and engineering, areas of studies that American-born citizens have, to a large extent, lost interest in.

Miguélez and Moreno (2014) examine the reasons for mobility between European NUTS2 regions of inventors. Their results reveal that physical proximity, job opportunities, and social networks are important in explaining mobility patterns. Miguélez (2016) studies how the migration of inventors (i.e., diasporas) shapes international co-inventor networks in developing and industrialized countries. He finds a strong relationship between diasporas and international co-patenting in the years 1990–2010. This means that the migration of inventors helps internationalize and diffuse knowledge internationally as well as to their countries of origin. On the other hand, Beine et al. (2011) show, using an international dataset of migration by education level, 1990–2010, that the presence of diaspora in a country tends to instead attract individuals with lower education than those with higher education, thereby lowering the average education level. Because of the high explanatory power of diasporas this suggests that policies targeting, e.g., highly educated may only have moderate influence on further migration flows.

For the UK, Nathan (2015) uses a name-matching technique to identify the ethnicities of inventors listed on European Patent Office (EPO) records. Descriptively, the analysis uncovers a spatial clustering of ethnic inventors. He then estimates how individual level patenting is affected by ethnic group composition in the region of residence to find a small positive effect of inventor group diversity on individual patenting. He argues that the results indicate that learning externalities exist for diverse inventor groups and that this effect is somewhat stronger in urban locations.

Jahn and Steinhardt (2016) examine the effect of (mostly low-skilled) immigration on innovation in Germany and find a non-negative and possibly positive effect on innovations, as measured through patent applications in regions with relatively high immigration.

3.5 In summary

In sum, studies show diversity having a positive effect on innovation on the regional, firm, and sector levels. Research on the role of diversity in Sweden is limited, but the work that has been done is fairly consistent with other studies.

The overwhelming majority of papers studying the link between immigration and innovation on the individual level concerns the US. Recent years, however, have witnessed an increase in studies of Europe, and find positive effects from immigration on innovation. Swedish evidence indicates that immigrants are somewhat underrepresented as inventors in the first generation. Second-generation immigrants in Sweden perform less well than individuals born with Swedish parents, which suggests a problem of integration.

4 Positive effects of skilled immigration on trade

The relationship between immigration and trade has received a great deal of attention starting from early contributions by Gould (1994) and Head and Ries (1998), with an increasing number of studies in recent years. The most recent literature has also shifted its focus from macro-analyses at the country level to more fine-grained ones at the firm level, using matched employer-employee datasets. The effect of immigrants on trade may occur in different ways, and, in each case, this will depend on the specific role played by immigrants as economic actors able to boost trade. In this section, the effect of immigration on trade will be analyzed by distinguishing between immigrants as consumers and as firm employees: in each specific case, their role as “facilitators” of trade activities follows different logics and has different effects. In both cases, a distinction will be made between immigration as a whole and skilled migration, with a focus on the latter.

4.1 Immigrants as consumers

The first manner in which immigrants can influence the patterns of trade is through their role as consumers. Consumption patterns are highly correlated with national culture; hence, an inflow of immigrants in a specific destination country is often also likely to increase the demand for goods and services that are produced in the country of origin of such immigrants. This phenomenon is well documented in the existing literature. White (2007) labels this effect as “transplanted home bias”, which he is able to identify in patterns of importing to the US. Similar effects have been found also by McCallum (1995) for US-Canada trade, as well as by Helliwell (1997) and Engel and Rogers (1996).

The positive effect of migration on imports in the host country has been partly documented also for Nordic European countries. In the case of Denmark, White (2007) finds a positive effect of immigration on imports, but mainly for immigrants coming from high-income countries.⁶ On the contrary, Hatzigeorgiou and Lodefalk (2015a), using Swedish data trade flows at the country level, find that Swedish imports are not affected by immigration levels. They attribute this to the fact that most Swedish immigration up until recent years was mainly composed of refugees. Since these people often come from countries affected by conflict (which might have also reduced their production and export capacities), import effects might be less relevant.

These last findings seem to be very much in line with those of White and Tadesse (2010) for the US, as they also find evidence that refugee immigrants have a lower impact on US imports than other types of immigrants.

An additional factor to keep in mind is the degree of assimilation of immigrants in the country of destination. Using data from the US, Mundra (2010) finds that the more assimilated the immigrants, the lower their effect on trade. This occurs either because they gradually change their consumption behaviors, or because as time goes by ethnical entrepreneurship in the host country allows for the production of the same ethnical goods directly in the country of destination, hence substituting imports.

Interestingly, the home bias effect of immigration has also been found in looking at the phenomenon from the perspective of the origin country, and also for high-income countries

⁶ According to White’s (2007) estimates, an increase in immigrant has increased annual Danish imports from their home country, specifically rising from US \$394 to US \$407.

of origin. Hiller (2014) shows, for example, that the presence of a Danish diaspora in specific foreign countries positively influences the exports of Danish companies to those specific countries. Hatzigeorgiou and Lodefalk (2015a) also find a positive effect of the presence of Swedish emigrants on the export volumes of Swedish firms to those specific countries.

This export-boosting effect of emigrants for their country of origin has been confirmed also for other countries, such as New Zealand (Law et al. 2013) and Italy (Murat and Pistorresi 2009). It is, however, important to stress that the effect of diasporas abroad on the imports from the country of origin might not only be due to the “transplanted home bias” in consumption patterns. For the Italian case, for example, the empirical results suggest that Italian exports are not mainly driven by the consumption of imported products from Italy among communities of emigrants. Rather, exports increase because the emigrants allow for decreased information costs on business opportunities in the country of destination and, hence, favor business relationships between the two countries. This channel will be discussed more extensively in the following section. In the case of Swedish exports and Swedish emigrants, an additional factor that could explain part of the positive association is related to the importance of multinationals for the Swedish economy. As suggested by Hatzigeorgiou and Lodefalk (2015a), it may well be that Swedish emigrants live abroad because they are employed as assigned expatriates by Swedish multinationals, which also export to the foreign country. This might also contribute to the positive association found in the empirical analyses, especially when the country of destination is of a relatively small size.

4.2 Immigrants as employees

Another channel through which immigration can impact trade is represented by the decrease of information costs that often hinder the ability of firms to operate in international markets. International trade activity is strongly affected by transaction costs: in particular, firms’ international operations often incur what transaction cost theory defines as ex-ante information and search costs (Williamson 1979). These can be mainly thought of as market and agent information costs arising when firms need to identify reliable local business partners, suppliers, or customers in geographically and culturally distant markets. A lack of knowledge about foreign markets, as well as the behavior of agents, typically exacerbates uncertainty among firms and affects their risk-taking, resulting in additional costs that firms need to undertake if they want to trade with foreign partners (Andersson and Weiss 2012). In this respect, immigrants can provide firms with very detailed and specific knowledge about the country (or the geographical area) from which they originally hail. Indeed, immigrants have superior knowledge of their home country markets, as well as the language and the specific laws and business practices that matter when engaged in trade activity (Law et al. 2013). Their knowledge of their home countries might also allow them to detect specific business opportunities in these countries, which can be exploited by the firms for which they work (Drori, Honig and Ginsberg 2010), and that would not be detected otherwise. Finally, immigrants may also act as knowledge brokers, by providing access to specific networks of contacts in their home countries, which may decrease opportunistic behaviors among commercial partners and help foster trade activities. It must be stressed that these costs are likely to be even higher for SMEs with limited knowledge of international markets and few resources available to invest in the hiring of personnel specifically trained for trade activities.

Most studies have documented this effect using data aggregated at the country level. A typical outcome of such empirical studies is that immigrants from more culturally diverse countries of origin, in particular, exert a positive influence on the host country's trade (White and Tadesse 2010; Peri and Requena-Silvente 2010). Since most of these studies are performed on high-income countries, this often means that it is mainly immigrants from developing countries (which are often more culturally distant) that have a pro-trade effect (White 2009). The reason is that, since in these countries institutions are weaker, immigrant employees can substantially decrease information and search costs. An important implication of these studies is that the pro-trade effect of immigrants is only expected to impact trade with their country of origin, and not on exports in general.

Another quite recurrent finding of this literature relates to the fact that the effect of immigrants on exports is stronger for differentiated goods, i.e. goods that require more information in order to complete transaction. This is reported by Peri and Requena-Silvente (2010) using country level aggregated Spanish data, as well as by Briant et al. (2014), who show that in France immigration is especially important for the export of complex products.

An important limitation of studies that use immigration and trade data aggregated at the country level is that they only find a positive correlation between the local presence of immigrants and the export performance of firms. However, they are not able to check directly whether it is the same firms that hire immigrants that are also able to boost their export performance. A number of recent empirical studies have used matched employer-employee datasets to account for this, and in the majority of the cases, these studies use data from Nordic European countries. Hiller (2013), using a comprehensive matched employer-employee dataset for Denmark, finds that hiring a foreign employee allows firms to boost export performance to the specific country of origin of that employee. The study also shows that, in order for companies to start exporting to a specific foreign market, having a large local pool of immigrants from that country of origin is not as effective as hiring some of those immigrants.

Hatzigeorgiou and Lodefalk (2016), using a Swedish matched employer-employee dataset, show similar results. While the total number of immigrants in the country also has a positive effect on the firm-specific export levels to that country of origin, the impact on exports that comes from hiring an immigrant from that country is much higher. Most importantly using firm-level data allows the authors to show that it is only small Swedish firms that benefit from hiring foreign employees: medium and large firms are not affected at all by the hiring of immigrants. Hatzigeorgiou and Lodefalk (2015b) also find similar results when they focus specifically on the export of services by Swedish firms: in this case, hiring immigrant employees also has a positive effect, and this effect is stronger for firms with limited international experience. Hatzigeorgiou et al. (2016) show that immigrants in Sweden also act as knowledge brokers for imports. Indeed, immigrants might have better knowledge about specific suppliers in their home countries, which might provide firms with imports that substitute the supply from local producers. Using a Swedish matched-employer-employee dataset, the study shows that hiring new immigrants increases the likelihood that firms will start importing intermediate inputs from foreign firms.

Recent evidence from other European countries using firm-level data confirms the positive effect of immigrants on exports to the country they are originally from. Andrews et al. (2017), using the nationality of workers in a large sample of German establishments, find a

similar positive effect, which is especially strong with respect to the origin of workers. Pennerstorfer (2016) uses export data at the firm level for a sample of firms in Austria, the Czech Republic, Slovakia, and Hungary. The study finds a positive correlation between the presence of immigrants in a region and the export performance of firms in that region with respect to the country of origin of the immigrant community. While the results are not based on firm-level employment data, and hence are less precise than the studies mentioned above, they show that the presence of immigrants influences entry into new foreign markets, rather than export intensity.

It is also important to understand whether immigrant employees only boost exports to their country of origin or whether they also have an impact on trade with other countries. In this respect recent evidence on US data points to the role of immigrants as facilitators of trade also to countries that are “proximate” to the country of origin, i.e. similar in terms of geography, institutions, and language spoken (Firsin 2015). Even more interestingly, using French matched employer-employee data, Marchal and Nedoncelle (2017) show that immigrants boost firm exports not only for their countries of origin, but in general towards all destinations.

Education and occupations

Crucial factors that are able to influence immigrants’ contributions to trade performance are education and occupation. Some empirical analyses relying on country-level data have shown that the migrant effect is stronger for tertiary educated immigrants (Sangita 2013; Giovannetti and Lanati 2017). These results, however, are not confirmed in all country-level analyses, as shown by Piperakis (2011), who finds that high-skilled immigrants do not have a positive effect on trade among EU15 countries.

Micro-level empirical studies using matched employer-employee datasets instead point more unequivocally to the role of skilled migrants as the main actors in fostering exports. Hatzigeorgiou and Lodefalk (2016) find that it is mainly skilled immigrants that boost the export performance of Swedish firms. Marchal and Nedoncelle (2017) also find that the positive effect of immigrants among French firms is driven by skilled ones.

Andrews et al. (2017) instead use data on occupations to measure the competencies of immigrant employees in German firms: their results show that the positive effect of immigrants is stronger for immigrants who hold senior occupations, in that they “are more likely to have a role in exporting decisions”. These results are in line with other existing studies that instead use country or regional data: Aleksynska and Peri (2014), using country-level data for 89 destination countries and 233 countries of origin, show that immigrant managers contribute more to trade, especially if they are highly educated. Similar results are found by Martín-Montaner et al. (2014) using cross-country data from 191 countries: they confirm that it is the presence of immigrants in managerial positions, in particular, which correlates with trade. Finally, using US data, Mundra (2014) finds that professional immigrants (i.e. those employed in occupations that require higher skills) are especially important to trade performance.

Temporary migrants

An additional dimension has to do with the amount of time that an immigrant is resident in the host country. In the Swedish context, Hatzigeorgiou and Lodefalk (2016) find that the effect of (mainly skilled) immigrants on the export performance of Swedish firms is stronger for individuals who have lived in the host country for a limited amount of time.

Lodefalk (2016) provides an even deeper analysis on this issue, showing that it is mainly temporary expats (i.e. individuals who arrived in Sweden to work and have been resident in Sweden for less than four years) who provide the greatest benefit to the export performance of Swedish firms. The results confirm that these effects are country-specific, and that it is stronger for the export of services than for merchandise goods. Lodefalk's findings are partly in line with the results of Jansen and Piermartini (2009). Using cross-country data, the authors find that temporary migration has a positive effect on trade towards the specific country of origin of immigrants. However, an important difference between the two studies is that Lodefalk's definition of temporary expats also includes natives who have lived abroad for some time and then come back to work in their home country.

Alternative explanations of immigrant employees' effects

So far, the main explanation for the positive effect of immigrants on trade has relied on the assumption of decreased information and search costs enabled by the specific tacit knowledge of immigrants with respect to their country of origin. With few exceptions (see the case of Firsin 2015), this implies that the impact of skilled and unskilled immigrants on firms' trade performance is only limited to their country of origin. However, recent studies have started to explore novel and alternative channels through which immigrants could boost firms' trade.

The first is the productivity channel, as formulated by Mitaritonna, Orefice, and Peri (2017). The authors shows that in the period 1995–2005 in France a specific category of firms benefited the most from hiring (mainly skilled) immigrants. These were small and low-productive firms, who, by hiring immigrants, were able to increase their productivity and levels of investment in physical capital. An additional finding of the study is that the hiring of skilled immigrants also helped these small and initially low-productive firms to increase their export. In this case, however, the improved export performance is more of a direct consequence of increased productivity, rather than a consequence of decreased information costs. Indeed, in this case, improved export performance can simply be a result of the increased productivity that allows firms to face the high fixed costs of export entry (see also the previous section on the impact of immigration on productivity). Although this explanation is not necessarily at odds with the usual explanation that concerns information costs, but is rather complementary, its main implication is that the positive effect of immigrant employees on trade (export in particular) is not solely related to their own country of origin.

A completely different channel is instead the diversity channel proposed by Parrotta et al. (2016): here the effect of immigrants on trade is not country-specific, but rather, it is related to the presence of a diverse workforce in a company. In line with the theory of relational capital put forward by Mohr and Shoobridge (2011), a diverse workforce may allow firms to engage with different values, norms, and tastes that favor the internationalization of companies with several foreign markets simultaneously. Parrotta et al. (2016) find that this is a relevant fact for Danish firms: ethnic diversity increases internationalization; it does not increase export intensity, but rather, it increases the number of foreign markets in which firms are present.

4.3 In summary

Summing up, according to existing empirical evidence, the effect of immigrants on imports through nationally biased consumer preferences that were reported for the US and other

countries seems to be less strong among immigrant communities in the Nordic countries. On the contrary, there is evidence of a positive association between the presence of emigrant communities from Sweden and Denmark and the level of exports from the country of origin to the foreign country in which the communities are based. However, it is not easy to assess whether it is exclusively consumer preferences that determine these patterns. The existing literature does not provide a clear distinction between the impact of skilled and unskilled immigrants, most probably because there are no strong a priori distinctions in the consumption patterns of national products between the two categories of immigrants.

Analyses of the effect of immigrant employees on firm trade performance has found very robust evidence corroborating the intuition that immigrants' knowledge of their home countries can be used by firms to export to or import goods from these countries. The results are confirmed both by empirical studies that use cross-country aggregated data and by more precise studies using employer-employee datasets. In particular, micro-studies on Swedish and German data find that skilled immigrant employees are most effective in boosting export performance, as well as immigrants employed in more senior occupations. Existing studies at both the micro- and macro-levels show that the role of immigrants as trade brokers is more effective in the first years upon arriving in a host country, and that it declines over time. Finally, the impact of immigrants on export is usually found to affect only exports to their own country of origin. All these findings are particularly robust for the Swedish case, especially when matched employer-employee data are used. Besides these well-established empirical findings, however, recent studies that use mainly French data have shown that, by boosting the productivity of firms, (mainly skilled) immigrants can allow firms to pay the fixed costs related to export activities and hence boost exporting in general (not only to specific destinations). Also, studies using Danish data show that a diverse workforce allows firms to increase their general ability to manage different cultures, norms, and institutions, and hence improve their export performance to different countries simultaneously.

5 Discussion

The aim of this literature review was to investigate the current academic literature regarding the effects of immigration on economic growth, productivity, innovation, and trade. This chapter further discusses the results as well as how immigration policy can influence the studied phenomena. Finally, the chapter elaborates on potential directions for future research.

Immigration, growth, productivity, and innovation

The literature review reveals that little research has been done on the effects of immigration on economic growth, productivity, and innovation in Sweden. There has, however, been a great deal of work done in other countries and, in the Nordic context, on Danish data. The empirical literature on immigration and growth within the EU generally shows positive effects. There is some evidence that the highly educated contribute more to growth than others have, and one study suggests that Sweden has benefited more from this than other countries.

With respect to productivity, the literature reports mainly positive effects. For Denmark, a detailed finding is that local natives tend to move to jobs that require greater communication skills and can thus be considered as being more qualified.

With respect to regional innovation, several studies have investigated the effects of ethnic diversity on a regional level. Many use patent data and confirm positive effects from diversity. However, we have not found literature for any Nordic country on regional innovation effects from immigration.

At the firm level, the diversity-framing perspective recurs. Different outcome measures are used for different countries, namely productivity patenting and product innovation. One study on Sweden has found, using CIS data, a positive effect on radical innovation, but not on incremental innovation. Thus, several studies have found positive effects.

A few studies take a sectorial innovation perspective. Here one study found a negative effect from immigration for Spain, but not for the UK. Another study found positive effects on firm patenting in France, Germany, and the UK, mainly in high-tech sectors and from highly educated immigrants.

At the individual level a large range of studies exist. In the United States, there is evidence that immigration of inventors has long-run positive effects on inventive activity. If we focus on innovation effects in Europe, Northern European countries seem to be the main beneficiaries, in relative terms, of inventor inflows. However, one large-scale study on Sweden finds that immigrants are somewhat underrepresented as inventors, and that second-generation immigrants performed less well in invention than persons born with two Swedish parents. There are also several studies that point out the importance of increased knowledge exchange (measured by citations) from immigration; such links and flows may well further stimulate follow-up economic activity such as trade (Andersson and Ejermeo 2008).

Immigration and trade

The results of the empirical literature on immigration and trade provide some interesting implications for policy-making. Overall, it is possible to broadly define the impact of

immigration on trade in two categories. The first has to do with the decreased costs of trade that immigrant employees provide for firms. This mechanism can be labelled as a “cost-based strategy” implemented by firms that can access new markets at a reduced cost because of the knowledge about the country of origin embodied in the immigrants who are hired. An important reason why firms hire immigrants could be that, in doing so, they can obtain access to relevant knowledge about foreign markets at a relatively low price. This knowledge could also be accessed by firms through other means. As shown by Mion and Oromolla (2014), managers with some work experience in sales in specific foreign markets (regardless of the managers’ nationalities) can also substantially boost the performance of companies aiming to export to that specific market. However, this strategy can sometimes be expensive.

In line with this argument, the empirical evidence shows that hiring an immigrant to boost firms’ export to a specific country is a strategy that is particularly well suited for firms with limited financial and organizational resources, i.e. small and relatively low productive firms. From a policy perspective, this means that the role of immigrants as facilitators of trade is of great importance, but it mainly applies to a specific subset of firms: it is probably more likely to allow firms with limited export experience to increase the number of foreign markets in which they are active. On the contrary, it is not likely to affect the performance of highly productive firms, which are already successful in international markets. Moreover, this is also likely to boost trade relationships, particularly with countries with weaker institutions, or with more distant cultures, while it is less likely to work for more familiar markets such as the European or US market (although firm-level studies do not check for which foreign markets are, on average, mainly affected by the hiring of immigrants). The empirical evidence suggests, however, that this strategy works better with skilled immigrants and, at least in the case of Sweden, with immigrants who have not been in the host country for very long.

On the contrary, the evidence put together by Parrotta et al (2016) suggests that skilled immigration can affect trade also through another channel: allowing for a more “global mindset” of its workforce that comes as a result of ethnic diversity. With respect to the previous cost-based strategy, this is a relatively different channel, according to which having a workforce with a heterogeneous and culturally unbiased mindset can help the international performance of companies. In this case, however, empirical analyses should be careful in assessing whether it is the local availability of an ethnically diverse workforce that allows for successful international performance, or if it is a strategic decision of firms to hire people from abroad to achieve such results. Many multinational corporations use the international mobility of their employees, through assigned expatriation, precisely in order to allow them to have a more global view of business matters. All this suggests that firms’ strategies should have a central role in analyses that aim to detect the impact of skilled immigration on trade, since firms are not simply passive recipients of foreign workforce, but active seekers of international competencies.

Immigration policy as a means to influence the studied phenomena

One interesting aspect of the relationships we study in this review is whether policies, such as changes in border control, visa policies, labor market integration, or tax policy, can influence the phenomena we are studying, in particular the effects on innovative activity.

In 1992, China allowed its students to become permanent residents in the United States. Lan (2013) finds that this stimulated students to start working quickly. This increased their

patenting and wages but lowered the number of research articles relative to a later Chinese comparison group not subject to this shift.

Brunner and Pate (2016) conduct a simulation according to which US immigration policy would shift its (mainly) family reunification based policy towards a Canadian point-based policy. The point system would require immigrants to fulfill two of three conditions: 1) hold a high school or college degree, 2) be less than 40 years old, and 3) work in a professional occupation. Their simulations show that this would increase the skill levels and earnings of immigrants and would result in a reduction in inequality. Source countries would substantially change, away from Central American and to European and Asian countries.

Prominent, and much debated in the US is the H-1B visa program that targets labor migration in science and engineering (S&E) professions. Kerr and Lincoln (2010) find that during times when the number of visa admissions were higher, there has been an increase in S&E employment and an increased rate of patenting by individuals with Indian and Chinese names in cities dependent on the program. They do not find evidence of displacement effects for natives. Shih (2016) similarly exploits the natural experiment of a 2003 reduction in the H-1B cap to estimate its effect on student intake. He finds that the reduction led to a 10 per cent drop in enrollment by international students. Sparber (2018) argues that, instead of randomly allocating H-1B permits, policymakers should choose to distribute permits based on ability (as gauged by wages) and concludes that this could raise output by \$26.5 billion over six years.

A few papers examine the consequences of the enactment of the European Economic Area (EEA), in 1994, which allowed free mobility for work within EU and EFTA countries. According to the theory on self-selection of migrants (Borjas 1987), free mobility should lead to migration to countries where there are the greatest rewards for skills. A country like Sweden has a more compressed earnings distribution and rewards low-skilled labor much better than, e.g., the United States. In this sense, the effects of liberalization could differ depending on conditions existing prior to liberalization and on income distributions. Huber and Bock-Schappelwein (2014) examine the effects of the EEA on the immigration of workers to Austria, and Ejermo and Zheng (2018) on Sweden. Despite similar patterns of immigration flows and welfare state ambitions, the countries differed. In Austria, the effect seems to have been mainly to increase the share of high-skilled workers; in Sweden the opposite, as gauged by education levels. Huber and Bock-Schappelwein (2014) argue that the effect in Austria came as the result of a relative saturation of low-skilled worker demand prior to the EEA enactment. In Sweden, the effects of an increased level of immigration of low-skilled workers seem to have been short term in nature, returning to normal levels a few years later. Ejermo and Zheng (2018) also examine the effects on the inflow of immigrants who become inventors using employer-employee linked data on inventors listed on European Patent Office records, but find no statistically significant effect of the EEA, possibly because the number of inventors in total from this region is quite small. A third related paper on EU-migration liberalization is that of Beerli and Indergand (2014), who conclude that the abolition of quotas in 2002 for workers from European countries had a small negative effect on the educational quality of immigrants to Switzerland.

The discussion above indirectly implies that taxes may play an important role in altering income distribution and subsequent immigration flows for skilled immigration. Akcigit et al. (2016) study the effect of the collapse of the Soviet Union, and marginal tax cuts in

Denmark and the United States, which are found to influence the migration patterns of top inventors. They then use a large international dataset on inventors and examine migration and tax rates. Their findings show that lowering the average top marginal tax rates from an average of 60 to 50 per cent increases an average country's influx of the top 1 per cent of foreign inventors by 26 per cent compared to the control group (those below the top 25 per cent). Especially relevant from a Swedish perspective are the Danish experiences of marginal tax cuts for 'experts'. A drop of the top tax rate of 60 per cent to 30 per cent for 1991–1995, and thereafter to 25 per cent for three years, gives rise to an estimated elasticity for Denmark of 0.7. In other words, a 1 per cent drop in the tax rate increased the percentage share of foreign inventors for domestic goods and services to 0.7 per cent. Malchow-Møller et al. (2018) analyze the effect of a tax reduction for "foreign experts" in Denmark for the period 1995–2007. Already in 1992, Denmark had implemented a flat tax of 30 per cent that extended to both non-Danish citizens and Danish citizens who worked at least three consecutive years abroad for a non-Danish employer. A second requirement for benefiting from this tax reduction was a salary of more than 8,000 euros per month). The results show that foreign experts have a positive effect on the overall salary levels of their colleagues in the firm that hires them, hinting at a general positive effect on the performance of the firms that hires them. The paper suggests that the tax incentive might have affected the performance of Danish firms. Also, Kleven et al. (2014) examine the Danish case. They show that the number of highly paid foreigners have doubled in Denmark. This implies that the elasticity to migrate is large, much larger than within-country elasticity, possibly indicating that benefits of preferential tax schemes are larger for small countries.

The tax scheme is similar to the "tax relief for foreign key personnel" introduced in Sweden in 2001 and further refined in 2012. The Swedish scheme is yet to be evaluated by peer-reviewed research. According to the original scheme, tax was paid only on 75 per cent of wage income, and reimbursements for housing, school fees, and travel were not taxed, for foreign experts. Moreover, the employer does not pay social fees on the top 25 per cent of wages. The original version involved an application procedure. Few applied, and several applications were rejected. According to an inquiry of more than 300 individuals and more than 300 firms by ITPS, the reasons for moving to Sweden were not so much the tax incentive, but rather career opportunities (Ericsson and Jonsson 2005). In 2012, a rule-based scheme was introduced. Although applicants could still choose to use the old application procedure, a second path was opened according to which individuals who earned more than two basic amounts (*basbelopp*: 91,000 kronor per month in 2018 or more than 9,000 euro), with no prerequisite for showing the individual to be an "expert" (Forskarskattenämnden 2018). The new version seems to attract more applications, though still fewer than 1,000 per year, and many applications are rejected (Forskarskattenämnden 2018). According to an evaluation made by the Swedish parliamentary committee for taxes, the new scheme is perceived as being more transparent and easier to apply for. However, key personnel such as university researchers do not normally earn as much as is needed to qualify (Skatteutskottet 2013), and it can be noted that the income levels required are clearly higher in Sweden than in Denmark. Despite this, data compiled at CIRCLE research center at Lund University (unpublished) on the number of foreign-born researchers in academia indicate a dramatic increase since 2008, especially from Asian countries, the causes of which remain to be fully understood.

Migration barriers not only affect migration flows, they also seem to affect flows of knowledge. Orazbayev (2017) studies the effects of migration barriers on international

knowledge flows. Knowledge flows are measured by international citations in publications from Web of Science. He finds that a moderate increase in barriers decreases knowledge flows by about 1 per cent per year.

Another recent policy change concerns attempts to harmonize highly skilled migration policies across the European Union by introducing a Blue Card in 2009. The consequences of this in terms of immigration of high-skilled in the EU have generally been disappointing (Lissoni 2017). However, national implementation has varied greatly. Sweden implemented a change in immigration law for both high- and low-skilled immigrants in December 2008, which will be discussed in a later report.

Further studies

Lastly, it is useful to identify some possible avenues for future research. While it would certainly be interesting to replicate several of the existing studies on the role of immigration, productivity and innovation, a fruitful way forward would also be to evaluate the role of policy changes for the outcomes that have been discussed in this report. We can identify four policy areas: 1) changes to the system for tax relief for foreign experts, 2) the new work visa policy introduced in 2008, 3) the introduction of study fees for foreign students in 2011, and 4) the (continued) labor market integration of the EU. Such additions to the literature would also have the benefit of identifying plausibly causal effects that could reveal the effectiveness of the initiated policies.

Other interesting extensions of these studies have to do with the role of ethnic entrepreneurship. Indeed, not controlling for the ethnicity of the entrepreneurs who hire immigrants risks overlooking the role played by ethnic-based businesses. Entrepreneurs with a foreign background often hire personnel from their same ethnic group, as shown by Andersson and Wadensjö (2009), who found that, in Sweden, foreign entrepreneurs are more likely to hire foreign labor. If that is the case, some of the effect found in the literature on immigrant employees might be driven by the operations of companies led by foreign entrepreneurs, who might be more willing to hire foreign employees and also be interested in exploring foreign markets. The emerging literature on the effects of immigrant entrepreneurship on trade still lacks solid empirical grounds, especially for the European context. While some studies (Bratti et al. 2018) find that ethnic entrepreneurship is able to boost regional export performance in Italy, other studies (Baklanov et al. 2014; Granabetter 2016) using Danish and Austrian data fail to find a higher export propensity of migrant entrepreneurs with respect to their native counterparts.

Another potential channel through which skilled immigrants might affect the trade performance of companies might occur through the recruitment by local firms of foreign graduate students who completed their education in the host country. Hiring foreign graduate students does not entail high search costs, as they are already present in the country. At the same time, they embody specific knowledge about their country of origin (although presumably without much work experience), and they are highly qualified individuals who already know the host country's overall system. Also, in the case of Sweden and other Nordic countries, this seems like an interesting avenue for future research.

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Sakkunniga medarbetare, unika databaser och utvecklade samarbeten på nationell och internationell nivå är viktiga tillgångar i vårt arbete. Genom en bred dialog blir vårt arbete relevant och förankras hos de som berörs.

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