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Abstract

Studies routinely document that the nature of immigrant employment is largely specific: it often concentrates in non-traded goods sectors and many immigrants often have low inter-sectoral mobility. We consider these observed characteristics of immigrant employment for the question of how immigration affects a nation's pattern of production and trade. We model an economy producing three goods; one is non-traded. Domestic labor and capital are domestically mobile but internationally immobile. Any new wave of immigration is assumed to comprise some workers who will become specific to the non-traded goods sector. The model indicates that the output and trade effects of immigration depend importantly on the sectoral pattern of employment of existing and new immigrants. Empirical investigation in a panel dataset of OECD countries supports the models prediction that immigration raises the output of non-traded goods. Consistent with the model, we also find that immigration and trade are complements. The implications of the model and empirical findings for immigration policy are then discussed.

Zusammenfassung

Diverse Studien belegen, dass die Beschäftigung von Immigranten sehr spezifisch ist: Sie beschränkt sich häufig auf Anstellungen in der Produktion nicht gehandelter Waren. Der Großteil der Immigranten zeigt dabei nur eine geringe Mobilität zwischen den Sektoren. Unter Berücksichtigung dieser beobachteten Besonderheiten bei der Beschäftigung von Immigranten untersuchen wir die Auswirkungen von Immigration auf die Handels- und Produktionsstrukturen eines Staates. Unser Modell umfasst eine Volkswirtschaft, die drei Güter produziert; eines davon wird nicht gehandelt. Heimische Arbeitskräfte sind innerstaatlich mobil, aber immobil auf internationaler Ebene. Es wird angenommen, dass jede neue Immigrationswelle Arbeiter mit sich bringt, welche in Wirtschaftszweigen nicht gehandelter Güter beschäftigt werden. Das Modell zeigt, dass die durch Immigration verursachten Auswirkungen auf Produktion und Handel stark von branchenspezifischen Beschäftigungsmustern vorhandener und neuer Immigranten abhängig sind. Die empirische Untersuchung des prognostizierten Zusammenhangs von Immigration und Handelsströmen basiert auf einem Datensatz von OECD Ländern und bekräftigt die Vorhersage, dass Handel und Immigration Komplemente sind. Abschließend wird die Bedeutung des Modells und der empirischen Ergebnisse für die Gestaltung von Immigrationspolitik diskutiert.

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1. Introduction

The effect of immigration on an economy is a topic of continuing importance. Always a central issue in the U.S. context, immigration has also become central in the European Union (EU) context: the expectation of potentially large flows of workers from peripheral countries raised sufficient fears about adverse labor market and government budget impacts to cause EU-15 countries to block acceding countries' workers from their markets for up to seven years. Such fears underscore that the effects of immigration on an economy are not yet fully understood.[1] The ongoing political debate, and the rising employment share of non-native workers in most OECD countries (e.g., OECD 2011), suggests that understanding the effects of immigration on an economy is both of increasing importance and increasing relevance.

A central focus of the economics literature on immigration is the impact of immigration on domestic wages. Early studies using partial equilibrium frameworks found little evidence of significant wage effects from immigration.[2] Later studies using general equilibrium frameworks suggested an absence of significant wage effects may reflect the operation of a Rybczynski effect: an immigration-induced increase in labor supply is absorbed not by a change in domestic factor prices but instead by a reallocation of labor (and other productive factors) across sectors and hence by a change in the sectoral pattern of production. Hansen and Slaughter (1999) find evidence that migration flows between U.S. states mainly alter a state's pattern of production rather than wages. If the primary effect of immigration is to induce a reallocation of resources across industries with little change in factor prices,[3] then the question of interest becomes how immigration may impact a nation's sectoral pattern of production. Despite its seeming importance, how immigration impacts a nation's sectoral pattern of production is a question that has received limited attention in the literature dealing with the economy-wide effects of immigration.

How immigration may impact a nation's sectoral pattern of production is linked to the long-standing question in the international trade literature of whether goods trade and international factor move-

1 Borjas (1994, 1995, and 2003) reviews the economic benefits of immigration. Dustman et al. (2005) examine labor market effects of immigration.
2 Friedberg and Hunt (1995) and Docquier et al. (2011) review studies on the wage effects of immigration.
3 For the U.S., Borjas (2003) calculates that immigration between 1980 and 2000 depressed U.S. wages by 3% to 4%. Even smaller wage effects are found when examined at a local rather than national level (e.g., Card 2001).

ments are substitutes or complements.[4] In addressing this question, the main focus of the theoretical and empirical trade literature has been on international capital mobility, and has concluded that trade and international capital flows can be either substitutes or complements. However, in most theoretical trade models, whether a substitute or complement relationship emerges follow entirely from which traded good sector (exports or import-competing) is assumed intensive in the internationally mobile factor (e.g., Markusen 1983; Neary 1995) as well as the (often implicit) assumption that the internationally mobile factor and its domestic counterpart are homogenous. Hence, as with capital flows, prior studies of international labor flows do not differentiate characteristics of immigrant labor from those of domestic labor, even if a distinction is made between workers with differing levels of skill (e.g., Felbermayr & Kohler 2007). As shown in this paper, treating immigrants and native workers as homogenous precludes a more general understanding of the economy-wide effects of immigration.

This paper addresses, both theoretically and empirically, the question of how immigration impacts a nation's sectoral pattern of production and trade, and hence also the question of whether trade and international labor flows are substitutes or complements.[5] We first address this question theoretically by developing a model of a small open economy with internationally mobile labor. The model is parsimonious, and its structure is specifically designed to capture two observed characteristics of immigrant employment that differentiate some immigrant workers from native-born workers. First, as is widely documented (e.g., OECD 2002; Dimararanan and McDougall 2002), many immigrants work in low-skilled service sector occupations (e.g., hotels, restaurants, etc.) and hence work in sectors whose output is not internationally traded. Second, some immigrant workers have low inter-sectoral mobility due to factors such as language barriers, low skill levels, and possible illegal status, and are therefore likely to remain employed in sectors producing non-traded goods and services. For example, the OECD (2004, p. 64) reports that: "...foreigners are ...over-represented in groups at risk of poor labour market integration...." Moreover, "The extent of language ability, the presence of protected jobs and the social capital deficiency contribute to additional barriers to foreign workers. Thus, certain groups of foreign workers face serious, lasting challenges for sustainable labour market integration."

4 Important early investigations using the Heckscher-Ohlin (H-O) model include Mundell (1957), Markusen (1983), Ethier and Svensson (1986), Svensson (1984), Markusen and Svensson (1985), Neary (1995) and Wong (1986); more recently Carbaugh (2007).

5 The substitutes/complements question is analyzed here in the sense of Markusen (1983): if an inflow of an internationally mobile factor raises (reduces) trade then trade and that factor are complements (substitutes). An alternative definition, first associated with Mundell (1957), concerns the relationship between goods trade, output prices, and factor prices between countries.

Our model captures the observed concentration of immigrant employment in non-traded sectors by introducing a non-traded good in a model of an economy that also produces two traded goods (exported and import-competing).[6] To capture the low inter-sectoral mobility of some immigrant workers our model assumes that some immigrant workers are specific to the non-traded sector.[7] An important feature of our model is that we allow a given inflow of new immigrants to contain a heterogeneous mix of workers (i.e., sector-specific and domestically mobile), thereby extending most prior analyses that assume immigrants and native workers are homogenous. Importantly, by allowing a heterogeneous mix of immigrants, whether trade and international labor flows are substitutes or complements in our model is not simply a result that arises, as in prior models, from specifying *a priori* the sector that is intensive in, or exclusively employs, the internationally mobile factor.[8]

The structure of our model has similarities to the specific factors model used by Felbermayr and Kohler (2007) to examine wage and welfare effects of immigration for an economy that produces one non-traded and one exported good, and where internationally mobile labor is differentiated by level of skill. Like the model developed in this paper, their model allows a given inflow of new migrants to contain a mix of worker types (i.e., skill levels). Yet, as in earlier theoretical work examining international capital mobility in a specific factors model with a non-traded good (see footnote 7), their model contains only a single "tradables" sector which precludes a complete understanding of how immigration alters the *pattern* of a nation's production across traded (exported and import-competing) and non-traded sectors. Moreover, while their model simulations do indicate a dependence of wage and welfare effects on the relative mix of different immigrant types, the empirical relevance of their simulations is equivocal.

Given our model, we then examine empirically its predictions for the relationship between immigration and a nation's pattern of production and trade using panel data on twenty-two OECD countries for the period from 1970 to 2009. Prior empirical evidence on the nature of the relationship between international labor flows and goods trade is mixed. Leibfritz, O'Brien, and Dumont (2003) conclude from their

6 Grether, de Melo, and Muller (2001) analysis of the political economy of immigration strongly suggests the importance of accounting for non-traded goods in international trade models.

7 Jones, Neary and Ruane (1983) were first to introduce a non-traded good in a traded goods model with sector a specific factor (capital). They used their model to demonstrate the possibility of two-way capital flows between countries. Since their model had only a single "tradables" sector, they could not address how international capital flows alter the composition of output across export- and import-competing sectors, and hence address the complements/substitutes question

8 For example, Neary (1995), building on Jones (1971) in which capital is internationally mobile but sector-specific, finds trade and international capital flows are substitutes whereas Markusen (1983) finds a complement relationship. As in earlier work using the H-O model, these different findings are fundamentally driven by which sector (export or import-competing) is assumed intensive in, or to exclusively employ, the internationally mobile factor.

review of the empirical literature that while earlier empirical studies mostly suggested a substitute relationship more recent work does not.[9] However, most prior studies only examine data for a single country or a particular region. In addition, in many cases only simple correlations or casual empiricism are used (e.g., Straubhaar 1988); Molle 2001). Our empirical analysis is therefore an important contribution to the literature examining the nature of the relationship between international labor flows and a nation's pattern of production and trade. Our empirical results broadly support our model's predictions for the impact of immigration on a nation's sectoral pattern of production and trade and hence underscore the importance of accounting for special characteristics of immigrants and the nature of their employment to gain a better understanding of the economy-wide effects of immigration.

This paper's approach to examining how immigration impacts a nation's sectoral pattern of production and trade derives from the international trade literature rather than the labor economics literature. While both literatures are grounded in microeconomic theory, the international trade literature routinely adopts a general equilibrium perspective while the labor economics literature often focuses on the labor market and associated variables (e.g., wages). Of course, these literatures often overlap.[10] Notable examples include the "immigrant-trade link" literature pioneered by Gould (1994) that examines, among other things, how immigrants' country of origin impacts a host nation's pattern of bilateral trade flows and Head and Ries (1998), who examine how the category of immigrants (independent, family, etc.) influences the volume of a nation's trade.[11] We further remark that our analysis does not address either the antecedents of immigration or its socio-economic impacts, subjects on which there exists a large and expanding literature.[12]

9 For example, Straubhaar (1988) and Molle (2001) find a substitute relationship based on the simple correlation between changes in intra-EU trade and intra-EU labor flows. Cogneau and Tapinos (1995) find a complementary relationship for Morocco, as does Richards (1994) for Latin America. Melchor del Rio and Thorwarth (2006) argue for a complement relationship upon finding that increased U.S.-Mexico bilateral trade, post-NAFTA, was accompanied by greater (illegal) migration from Mexico to the U.S.

10 Their differing approaches can also lead to controversy. For example, witness the 1990s debate on whether changes in U.S. international trade patterns were the proximate cause of the rising wages of skilled relative to unskilled workers in the U.S., or more generally the impact of international trade on employment (e.g., WTO 2007).

11 Using a gravity equation specification, this literature has generally found a positive effect of immigration on a nation's bilateral trade. Genc et al. (2011) and Parsons (2012) survey recent empirical work in this literature. Notable is that Parsons (2012) finds evidence that the estimates obtained in prior studies are subject to biases, and that once these biases are controlled for, immigration is found to have no effect on bilateral trade flows.

12 cf. footnote 1 and de Palo, Faini & Venturini (2006). See Davis and Weinstein (2002) for analysis in a Ricardian framework of factor mobility driven by the technological superiority of one country.

2. Theoretical Model

We assume a small open economy producing three goods: an export good (x), an import-competing good (m), and a non-traded good (n). There are three factors of production: capital (k), domestic labor (d), and immigrant labor (i). All markets are perfectly competitive. Capital and domestic labor are freely mobile across all sectors whereas immigrant labor is specific to the non-traded sector. We emphasize that "immigrant" labor refers here only to those non-native workers who are specific to the non-traded sector; it does not refer to all non-native workers, some of which, like native workers, are mobile across all three sectors.

Let V_z denote the fixed domestic supply of factor "z," Q_j the output in sector "j," and a_{zj} the amount of factor "z" used to produce one unit of output in sector "j." The full employment conditions for the model can then be written:

(1) $$V_d = a_{dx}Q_x + a_{dm}Q_m + a_{dn}Q_n$$

(2) $$V_k = a_{kx}Q_x + a_{km}Q_m + a_{kn}Q_n$$

(3) $$V_i = a_{in}Q_n$$

We assume export production is capital-intensive, import-competing production is domestic labor-intensive, and non-traded production is the most labor-intensive in terms of total labor employed per unit of capital; the assumed ordering of capital-labor ratios is therefore $a_{kx}/a_{dx} > a_{km}/a_{dm} > a_{kn}/(a_{dn} + a_{in})$. As written, the non-traded sector's capital-labor ratio appropriately measures capital relative to total labor (domestic plus sector-specific) employed. However, for later results, an assumption about capital used per unit of each type of worker will be needed; we assume the non-traded sector is the most domestic labor-intensive sector, so the complete ordering of capital-labor ratios is then:

(4) $$\frac{a_{kx}}{a_{dx}} > \frac{a_{km}}{a_{dm}} > \frac{a_{kn}}{a_{dn}} > \frac{a_{kn}}{a_{in}} > \frac{a_{kn}}{(a_{dn} + a_{in})}.$$ [13]

13 This ordering implicitly assumes sector-specific workers are less productive than domestically mobile workers in the non-traded sector, i.e., ain > adn. This assumption does not qualitatively affect the conclusions derived from the model.

2.1 The Effects of Immigration on Production and Trade

The sectoral output changes, and by extension trade, that arise from immigration are found by totally differentiating equations (1) to (3) and then solving the resulting system for the output changes in terms of the changes in factor supplies.[14] Doing this yields the following comparative static equations written in matrix form:

$$(5)\quad \begin{pmatrix} dQ_x \\ dQ_m \\ dQ_n \end{pmatrix} = \begin{pmatrix} \dfrac{a_{km}a_{in}}{a_{in}a_{km}a_{dx} - a_{in}a_{kx}a_{dm}} & \dfrac{-a_{dm}a_{in}}{a_{in}a_{km}a_{dx} - a_{in}a_{kx}a_{dm}} & \dfrac{a_{dm}a_{kn} - a_{km}a_{dn}}{a_{in}a_{km}a_{dx} - a_{in}a_{kx}a_{dm}} \\ \dfrac{-a_{in}a_{kx}}{a_{in}a_{km}a_{dx} - a_{in}a_{kx}a_{dm}} & \dfrac{a_{in}a_{dx}}{a_{in}a_{km}a_{dx} - a_{in}a_{kx}a_{dm}} & \dfrac{a_{dn}a_{kx} - a_{kn}a_{dx}}{a_{in}a_{km}a_{dx} - a_{in}a_{kx}a_{dm}} \\ 0 & 0 & \dfrac{a_{km}a_{dx} - a_{dm}a_{kx}}{a_{in}a_{km}a_{dx} - a_{in}a_{kx}a_{dm}} \end{pmatrix} \begin{pmatrix} dV_d \\ dV_k \\ dV_i \end{pmatrix}$$

A novel feature of our model is that we allow an inflow of new migrants to contain a heterogeneous mix of worker types. Specifically, we assume a fraction λ ($0 \leq \lambda \leq 1$) of new migrants have domestic worker status and are hence freely mobile across all sectors. The remaining fraction ($1 - \lambda$) of new migrants instead become specific to the non-traded sector. Given this, an inflow of "*I*" new foreign workers increases the stock of mobile domestic workers by $dV_d = \lambda I$ and increases the stock of sector-specific immigrant workers by $dV_i = (1 - \lambda)I$. Inserting these factor supply changes into (5), and assuming without loss of generality that $I = 1$, yields the following expressions for the output change in each sector arising from immigration:

$$(6)\quad \frac{dQ_x}{dV_i} = \frac{(a_{dm}a_{kn} - a_{km}a_{dn}) + \lambda(a_{km}a_{in} + a_{km}a_{dn} - a_{dm}a_{kn})}{a_{in}\left(a_{km}a_{dx} - a_{kx}a_{dm}\right)},$$

$$(7)\quad \frac{dQ_m}{dV_i} = \frac{(a_{dn}a_{kx} - a_{kn}a_{dx}) + \lambda(-a_{in}a_{kx} - a_{dn}a_{kx} + a_{kn}a_{dx})}{a_{in}\left(a_{km}a_{dx} - a_{kx}a_{dm}\right)},$$

$$(8)\quad \frac{dQ_n}{dV_i} = \frac{(1-\lambda)(a_{km}a_{dx} - a_{kx}a_{dm})}{a_{in}\left(a_{km}a_{dx} - a_{kx}a_{dm}\right)}$$

14 We treat all output prices as parametric and therefore consider only the first order change in sectoral outputs consequent to increased immigration; hence, second order changes that may arise from any subsequent adjustment in the price of the non-traded good are not considered. Under normal regularity conditions, the second order changes do not reverse the direction of the first order changes but instead only affect the magnitude of the changes. Our analysis shares similarities to the earlier "Dutch Disease" literature which considered both first order (i.e., resource re-allocation) and second order (expenditure) effects in models containing a tradables and a non-tradables sector (Corden and Neary 1982). This literature shows that, in no case, does the secondary effect reverse the direction of the first order change in outputs. Consideration of second order changes arising from a change in the price of the non-traded good would be important if one were to examine the effects of immigration on factor prices or welfare (e.g., Felbermayr and Kohler 2007).

Since we assume export production is capital-intensive relative to import-competing production the denominator in each expression is negative.[15] Given this, the output response in each sector due to immigration is determined by the sign of the numerator in (6), (7) and (8).

2.1.1 The Export Sector

The change in export sector production arising from immigration is given by (the negative of) the sign of the numerator in (6) which, upon re-arrangement, can be written:

$$(9) \qquad (a_{in} + a_{dn})a_{dm}(1-\lambda)k_m\left[\left(s/(1-\lambda)\right)-\left(1-\left(k_n/k_m\right)\right)\right].$$

The terms $k_n = a_{kn}/(a_{in} + a_{dn})$ and $k_m = a_{km}/a_{dm}$ are respectively the capital-labor ratios in the non-traded and import-competing sectors. The term $s = a_{in}/(a_{in} + a_{dn})$ is the existing share of sector-specific (immigrant) workers in total non-traded sector employment. The sign of (9) depends only on the sign of the term in square brackets. Since the denominator in (6) is assumed negative, expression (6) is positive if (9) is negative.

Consider first the case λ = 0, so all new immigrants become specific to the non-traded sector.[16] In this case, the sign of (9) is given by the sign of $\left(k_n/(1-s)-k_m\right)$. Since $k_n/(1-s) = a_{kn}/a_{dn}$ is the ratio of capital to domestic labor employed in the non-traded sector, $\left(k_n/(1-s)-k_m\right)$ is negative since the import-competing sector is more capital-intensive than the non-traded sector (see (4)). Given this, (6) is positive, and hence export sector production rises when all new immigrants become specific to the non-traded sector.

The intuition for this result is as follows. First, to maintain full-employment the non-traded sector must expand if all new migrants are specific to that sector. To expand, the non-traded sector must also draw capital and labor from the export and import-competing sectors. Since the non-traded sector is the most labor-intensive, it must absorb more domestic type workers relative to capital. Since the import-

15 One could instead assume the import-competing sector is more capital-intensive than the export sector. However, our empirical analysis uses data on OECD countries and for most of these countries it is reasonable to assume that the export sector is more capital-intensive than the import-competing sector.

16 This is like the case of examining only an increase in immigrants that do not have legal status, as in Djajic (1997).

competing sector is domestic labor-intensive relative to the export sector, the import-competing sector is the main source of domestic type workers. As the import-competing sector contracts, it releases an excess of capital, some of which is absorbed by the export sector which expands, implying that the additional capital and domestic labor needed by the non-traded sector comes entirely from the contracting import-competing sector.

If a new inflow of foreign workers instead contains a mix of sector-specific and domestic-status workers (i.e., $0 < \lambda < 1$) then how export sector production responds to immigration depends in a complicated way on the terms in square brackets in (9). However, general insights are possible. Note first that $k_n/k_m < 1$ since the import-competing sector is assumed capital-intensive relative to the non-traded sector. This implies $\left(1-\left(k_n/k_m\right)\right)$ in (9) is strictly positive and less than one. Given this, (9) is unambiguously positive, and hence export good production unambiguously falls with immigration, if the initial share of sector-specific workers in total non-traded sector employment exceeds the fraction of new immigrants that become sector-specific, that is, if $s/(1-\lambda) \geq 1$. This condition is more likely the smaller the fraction $(1 - \lambda)$ of new migrants who become specific to the non-traded good sector. For $(1 - \lambda)$ sufficiently small, export sector production falls since immigration mainly raises the stock of mobile domestic workers who are more readily absorbed by the more labor-intensive import-competing sector. As the non-traded and import-competing sectors expand, they draw capital from the export sector which must contract. This result is equivalent to the standard Rybczynski effect in a two-sector model with domestically mobile capital and labor and the import-competing sector is assumed labor-intensive relative to the export sector.

If instead $s/(1-\lambda) < 1$ then (9) can be negative or positive, and hence export sector production can either rise or fall with immigration. To gain insight, we ask what conditions make it more likely that the export sector expands with immigration. Inspecting (9) under the assumption that $s/(1-\lambda) < 1$, one can deduce that the smaller is $s/(1-\lambda)$ the more likely is export sector production to rise with immigration (since (9) is then more likely negative). For $s/(1-\lambda)$ to be small, either the new inflow of foreign workers contains a high fraction of sector-specific workers (i.e., large $(1-\lambda)$) or sector-specific workers are initially as small share of total non-traded sector employment (i.e., small s). This suggests that for countries like the United States, who have significant total employment in non-traded sectors ((i.e.,

small *s*) and that also experience inflows of foreign workers likely to be sector-specific (i.e. large $(1-\lambda)$), immigration is more likely to increase rather than decrease export sector production.

Another condition making an increase in export production more likely relates to the relative sizes of the capital-labor ratios in the non-traded and import-competing sectors. Specifically, the smaller is k_n/k_m the more likely, other things equal, that (9) is negative and hence the more likely that the export sector expands with immigration. This follows since the smaller is k_n/k_m the closer to unity is $\left(1-\left(k_n/k_m\right)\right)$ and hence the more likely is $(1-(k_n/k_m))$ to exceed $s/(1-\lambda)$; here it should be recalled that we are assuming $s/(1-\lambda) < 1$. An alternative interpretation is that when $s/(1-\lambda) < 1$, the smaller is k_n/k_m the smaller can be the share $(1-\lambda)$ of sector-specific workers in any given inflow of new foreign workers and still have an increase in export sector output. [17]

The effect of immigration on export good production can be summarized as follows. When $\lambda = 0$ then $\frac{dQ_x}{dV_i} > 0\ (<0)$ if $\left(\frac{k_n}{(1-s)} - k_m\right) < 0\ (>0)$. When $0 < \lambda < 1$ then

$$(10)\qquad \begin{cases} \dfrac{dQ_x}{dV_i} < 0 \text{ if } \dfrac{s}{(1-\lambda)} \geq 1 \text{ or if } \dfrac{s}{(1-\lambda)} > \left(1-\dfrac{k_n}{k_m}\right) \\ \dfrac{dQ_x}{dV_i} > 0 \text{ if } \dfrac{s}{(1-\lambda)} < \left(1-\dfrac{k_n}{k_m}\right). \end{cases}$$

2.1.2 The Import-competing Sector

Expression (7) indicates how import-competing sector production responds to immigration. Re-arrangement of the numerator in (7) yields the following expression:

$$(11)\qquad (a_{in}+a_{ln})a_{lx}k_x(1-\lambda)\left[\left(1-\left(k_n/k_x\right)\right)-\left(s/(1-\lambda)\right)\right]$$

Comparison of (11) and (9) indicates an expected symmetry between these expressions. If all new immigrants will become specific to the non-traded sector (i.e., $\lambda = 0$) then the sign of (11) is given by

17 To illustrate, data on recent (legal) immigrants to England indicates that about 10% (= (1 - □)) take employment in non-traded service sectors. The data also indicate that the share of immigrants in total service sector employment (s) is 7.8%. These data imply that s/(1 – □) = 0.078/.1 = 0.78. Since s/(1 – □) < 1, export and import-competing production may rise or fall with immigration. Since England also experiences significant illegal immigration, the actual fraction of new immigrants who become sector-specific may be much higher – which strengthens the case for a decline in import-competing production and an increase in export production. To say more one would need to know the capital-labor ratio in services and in import-competing production.

the sign of $\left(k_x - k_n/(1-s)\right)$. Since $k_n/(1-s) = a_{kn}/a_{dn}$ is the ratio of capital to domestic labor employed in the non-traded sector, $\left(k_x - k_n/(1-s)\right)$ is positive given the assumption (see (4)) that the export sector is capital-intensive relative to the non-traded sector. Given this, (7) is negative and hence import-competing production falls if all new immigrants become specific to the non-traded sector.

This result, together with the previous result that export sector production rises when $\lambda = 0$, implies that trade increases when all new immigrants become specific to the non-traded sector. This follows since, assuming demand unchanged, a decline in import-competing production implies an increase in imports and, assuming balanced trade, also an increase in exports (which is anyway predicted when $\lambda = 0$). Hence, when all new immigrants become specific to the non-traded sector, *trade and immigration are complements*. Importantly, such complementary arises in our model without assuming, as does prior literature (e.g., Markusen 1983), that the internationally mobile factor is used intensively in the export sector.

Now consider the case $0 < \lambda < 1$, so that some new immigrants will have (mobile) domestic worker status. Similar to the export sector analysis, the term $\left(1 - \left(k_n/k_x\right)\right)$ in (11) is less than one since $k_n/k_x < 1$ given our assumption that the export sector is capital-intensive relative to the non-traded sector. Given this, (11) is unambiguously negative, and hence import-competing production unambiguously rises with immigration if $s/(1-\lambda) \geq 1$. From the export sector analysis we know export sector production unambiguously falls when $s/(1-\lambda) \geq 1$. Hence, in our model, *trade and immigration are substitutes* when the existing employment share of sector-specific immigrants exceeds the share of new immigrants that become sector-specific (i.e., when $s/(1-\lambda) \geq 1$). [18]

A substitute relationship can arise in our model because we have allowed a given inflow of migrants to contain a mixture of both sector-specific and domestic-status workers.[19] As found above, trade and immigration are unambiguously complements in our model if all new immigrants become sector-specific. This highlights the importance of accounting not only for the characteristics of immigrants

18 This implies trade and immigration are substitutes if the non-traded sector only employs sector-specific workers since, in this case, s = 1 and hence the condition for substitutes ($s/(1-\lambda) \geq 1$) always holds.

19 Again, this contrasts with prior work (e.g., Neary 1995) where a substitute relationship follows simply from assuming the internationally mobile factor is used intensively in, or is specific to, the import-competing sector.

(e.g., skilled versus unskilled, etc.) but also the sector and nature of employment (e.g. sector-specificity) of each type of immigrant when considering the effects of immigration on an economy.

If instead $s/(1-\lambda) < 1$ then, as for export production, import-competing production may rise or fall with immigration. When $s/(1-\lambda) < 1$, one can deduce by a reasoning similar to that done for export sector production the conditions under which import-competing production is more likely to fall. In this regard, expression (11) is more likely to be positive, and hence import-competing production more likely to fall, the smaller is $s/(1-\lambda)$. Intuitively, the larger is the fraction $(1-\lambda)$ of new foreign workers that become sector-specific the smaller is the increase in the stock of mobile domestic workers and hence the smaller the likelihood that immigration would increase import-competing production. From the export sector analysis it was found that the smaller is $s/(1-\lambda)$ the more likely is export production to rise with immigration. This, and the above import-competing sector analysis, suggests that the smaller is $s/(1-\lambda)$ the more likely are trade and immigration to be complements.

Finally, from (11), import-competing production is more likely to fall with immigration the more capital-intensive is the export sector relative to the non-traded sector (i.e., the smaller is k_n/k_x).

The preceding analysis of the effect of immigration on import-competing production can be summarized as follows. When $\lambda = 0$ then $\frac{dQ_m}{dV_i} > 0 \ (<0)$ if $\left(k_x - \frac{k_n}{(1-s)}\right) < 0 \ (>0)$. When $0 < \lambda < 1$ then

$$(12) \quad \begin{cases} \frac{dQ_m}{dV_i} > 0 \ \text{ if } \ \frac{s}{(1-\lambda)} \geq 1 \text{ or } \frac{s}{(1-\lambda)} > \left(1 - \frac{k_n}{k_x}\right) \\ \frac{dQ_m}{dV_i} < 0 \ \text{ if } \ \frac{s}{(1-\lambda)} < \left(1 - \frac{k_n}{k_x}\right). \end{cases}$$

2.1.3 The Non-Traded Goods Sector

The effect of immigration on production of the non-traded good is clear from (8) since this expression reduces to $dQ_n/dV_i = (1-\lambda)/a_{in}$. Therefore, non-traded sector production must rise if the new inflow of foreign workers contains at least some workers who become specific to the non-traded sector (i.e., $(1-\lambda) > 0$). Conversely, non-traded sector production is unchanged if all new immigrants have domestic worker status (i.e., $\lambda = 1$). Although production of the non-traded good must rise as long as some new immigrants become sector-specific, whether this expansion reduces export or import-

competing production depends on the fraction of new immigrants who are sector-specific compared to the existing share of sector-specific immigrants in non-traded sector total employment. As previously found, the greater is the fraction of immigrants that are sector-specific, and the lower the existing employment share of sector-specific immigrants in the non-traded sector, the more likely is immigration to raise export production and lower import-competing production, and hence to increase trade.

Lastly, our model indicates that export and import-competing production can either rise or fall when $s/(1 - \lambda) < 1$. Although a fall in production in both sectors is possible, it is not possible that both sectors expand since all three sectors would then need to increase their employment of capital, which is not possible since the stock of capital is fixed in our model.[20] Since non-traded sector production must rise if the new inflow of foreign workers contains some sector-specific foreign workers, one (or both) of the traded goods sectors must contract.

3. Empirical Analysis

This section examines empirically our model's prediction for the nature of the relationships between immigration, the output of non-traded goods (services), and trade (exports). Like our theoretical analysis, our empirical analysis is fundamentally uncovering the nature of the Rybczynski effect associated with an immigration induced increase in a nation's stock of workers. Relevant prior studies estimating Rybczynski effects include Wong (1988) and Kohli (1999, 2002). For the U.S., Wong (1988) estimates positive Rybczynski effects for both U.S. exports and U.S. imports with respect to an increase in either U.S. capital or labor, therefore suggesting a complement relationship. For Switzerland, Kohli (1999, 2002) estimates Rybczynski effects for exports and domestic (non-traded) goods with respect to a change in the stock of non-native workers in Switzerland. His estimates indicate that an increase in non-native workers would raise production of non-traded goods but have no statistically significant effect on export supply. Kohli offered no theoretical explanation for his results other than to suggest that the relatively large size of the estimated Rybczynski effect for non-traded goods may reflect that non-native worker employment concentrates in non-traded sectors.

20 If capital were also internationally mobile then this "capital shortage" might be relieved by an inflow of foreign capital. This may represent one channel by which immigration and capital flows are complementary, and it suggests why trade might be found empirically, as in Wong (1988), to be complementary with the international movement of both capital and labor.

In addition to these studies, a number of authors have, in the context of assessing the validity of the Heckscher-Ohlin (H-O) model, regressed the trade or output of a given sector on national factor supplies across countries (e.g., Bowen 1983 & 1989; Harrigan 1995 & 1997; Leamer 1984). While such studies provide, for a particular industry, an estimate of the change in trade or output that would arise from a change in the domestic supply of a given factor, such results do not directly indicate how the sectoral composition of production and trade respond at an aggregate level, and hence whether trade and a given factor are substitutes or complements at the level of an economy.

Our model predicts immigration will increase the output of non-traded goods as long as some new immigrants become specific to the non-traded sector. For exports, the effect of immigration depends on the relative mix of sector-specific and domestic-status workers within the inflow of new immigrants and the existing share of sector-specific immigrants employed in the non-traded sector. Our analysis of immigration and exports is therefore intended to identify empirically whether the actual relationship between exports and immigration is positive or negative, and consequently whether the data reveal immigration and exports to be complements or substitutes.

3.1 Model Specification

We estimate two relationships, one between immigration and services output and one between immigration and exports. In each case, we use GDP per capita to control for differences in the economic size of countries and, for services output, also for the known relationship between services output and GDP per capita.[21] We include the square of GDP per capita to allow for a possible nonlinear relationship between each dependent variable and GDP per capita. The first relationship we estimate – denoted as Model 1 – is:

$$(13) \quad Y_{it} = \beta_0 + \beta_1 (\text{Immigration}_{it-1}) + \beta_2 \cdot (\text{GDP per capita}_{it}) + \beta_3 (\text{GDP per capita}_{it})^2 + \varepsilon_{it.}$$

where Y_{it} is either exports or services output in country i at time t. Lagged immigration is used since we expect a lagged effect between the time migrants arrive and any subsequent impact on exports and services output. Our data sample includes three countries (Austria, Germany, and Switzerland) that had, at various times during the sample period, a “guest-worker” program. Such programs often

21 Across countries, GDP per capita is also highly correlated with the stock of capital per worker. Hence, GDP per capita can also be interpreted as a proxy for an economy’s capital-labor ratio.

channel new immigrant workers into sectors producing exported goods[22] and hence, if not taken into account, could bias downward estimates of the effect of immigration on services output and bias upward estimates of immigration's effect on exports.[23] We control for these potential effects at the country level by augmenting (13) to include a guest-worker dummy (GW) that equals 1 if a country had a guest-worker program in a given year. Denoted as Model 2, the augmented model is:

$$(14) \quad Y_{it} = \gamma_0 + \gamma_1(\text{Immigration}_{i,t-1}) + \gamma_2 (\text{GW}\times\text{Immigration}_{i,t-1}) + \gamma_3(\text{GW}) + \gamma_4\cdot(\text{GDP per capita}_{it}) + \gamma_5\cdot(\text{GDP per capita}_{it})^2 + \varepsilon_{it.}$$

Variable GW captures any effect that a guest-work program may have on the level of exports and services output. The interaction variable "GW×Immigration$_{i,t-1}$" instead captures any effect such programs have on the direction and size of the impact of lagged immigration on services output and exports.

Since our empirical analysis can be thought to be uncovering the sign of a Rybczynski effect associated with a change in a country's *stock* of workers[24] it would seem that the appropriate specification to estimate would involve the *level* of services output or exports in relation to the *stock* of immigrant workers. However, lacking reliable data on immigrant stocks, and for statistical reasons,[25] our models are estimated using the change (first difference) in each dependent variable and the GDP per capita controls. The use of first differences means our use of the flow rather than the stock of immigrants as an explanatory variable is appropriate.

Our theoretical model predicts a positive relationship between immigration and the output of *non-traded* services. We therefore limit our focus to data on non-financial services, which is further broken down into two categories: "wholesale/retail non-financial services" and "other non-financial services." For exports, we examine total exports of goods and services as well as each component separately: exports of goods and exports of services. Since either a complement or substitute relationship is theo-

22 For example, in Germany, most guest-workers were employed in manufacturing, notably in mining, metal and ferrous industries (e.g., Martin and Miller 1980; Danzar and Yaman 2010).

23 In the terminology of our theoretical model, such programs bias the mix of incoming foreign workers toward domestic-status workers.

24 Given this interpretation, one might expect our equation to also include data on the stocks of other productive factors such as capital. As noted in footnote 21, GDP per capita can be thought to proxy for these other factors.

25 As described in the data section to follow, tests detected the presence of first order autocorrelation for both services and exports. Therefore, we correctly need to first difference before estimation.

retically possible, we have no *a priori* expectation for the sign of the coefficient linking lagged immigration and exports.

3.2 Data

Annual data on total inflows of migrants for the period 1970-2009 were taken from the *OECD.Stat* database (OECD 2010). These data refer to permanent flows and therefore exclude tourists, etc. Data were available for twenty-two OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the U.K., and the U.S.

Data on gross domestic product, population, exports of goods and services, and the output (value added) of "wholesale/retail non-financial services" and "other non-financial services" were taken from the OECD National Accounts database (*OECD* 2010). The sector "other non-financial services" includes non-business services such as public administration and health care.[26] The "wholesale/retail non-financial services" sector encompasses wholesale and retail trade as well as hotel, restaurant, and transportation activities. Total services output is calculated as the sum of the outputs of these two service categories. The GDP, export, and services output data are all measured in constant (year 2000) U.S. dollars.

Since we have panel data, we performed standard tests for cross-sectional correlation, serial correlation in the panel, and group-wise heteroscedasticity. These tests indicated first order autocorrelation in the levels of both services output and exports. We correct for these AR1 processes using first differences in the respective data. Tests for group-wise heteroscedasticity using the modified Wald statistic indicated its presence. In addition, the Breusch-Pagan Lagrange Multiplier (LM) test for independence of the errors across panels indicated that the errors are not independent but are correlated across countries. Because we have an unbalanced panel, we were limited in our choice of corrective estimation techniques. We used the Prais-Winsten transformation to obtain panel-corrected standard errors

26 Given the high social spending in these areas by some countries in the panel, a measure of non-public services would be ideal. Unfortunately, we were limited by data availability.

to account for group-wise heteroscedasticity. We further specified that the covariance matrix be calculated using all available information.[27]

3.3 Results

3.3.1 Services Output

Table 1 reports results of estimating (13) and (14) for each of the three categories of services output. In all cases, the results for Model 1 (columns 1-3 in Table 1) and the results for Model 2 (columns 4-6 in Table 1) indicate a positive and significant relationship between lagged immigration and services output. We remark that, for each category of services output, the value of the coefficient on lagged immigration estimated using Model 1 is smaller (significantly[28]) than its corresponding value estimated using Model 2. This indicates, as conjectured, that guest worker programs bias downward the effect of immigration on services output. Overall, these results support the predictions of our theoretical model regarding the effect of immigration on the output of (non-traded) services.[29]

27 All estimations were performed using STATA's "xtpcse" routine with the "pairwise" option enabled.

28 The hypothesis that the value of the coefficient on lagged immigration estimated using Model 2 exceeds its value estimated using Model 1 was rejected at the 5% level for each of the three categories of services output.

29 Our analysis was also conducted using data on net immigration (immigration minus emigration) for the same sample of countries and time period. The results using net immigration were not qualitatively different that those presented for total immigration. The complete set of results as well as summary statistics for all variables is available from the authors upon request.

Table 1: Regressions of services output on lagged immigration

Variable	Model 1			Model 2		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total Services	**Other Services**	**Wholesale Services**	**Total Services**	**Other Services**	**Wholesale Services**
Immigration (lagged)	60.20**	23.62**	36.58**	77.60**	29.44**	48.16**
	(6.66)	(2.61)	(5.28)	(8.96)	(3.57)	(7.08)
Immigration (lagged) x Guest-worker dummy				-58.99**	-19.25**	-39.75**
				(8.75)	(3.78)	(6.85)
Guest-worker dummy				1411.82	40.69	1371.13
				(1158.07)	(485.59)	(859.20)
GDP per capita	6.74**	1.40**	5.34**	6.51**	1.32**	5.19**
	(0.99)	(0.37)	(0.71)	(0.89)	(0.34)	(0.65)
GDP per capita squared	-0.05	-0.02*	-0.03	-0.05	-0.02*	-0.03
	(0.04)	(0.01)	(0.03)	(0.04)	(0.01)	(0.03)
Constant	-2712.49*	-287.83	-2424.65**	-3201.31**	-413.61	-2787.71*
	(1157.85)	(415.18)	(861.75)	(1327.96)	(483.52)	(977.81)
R-Squared	0.47	0.48	0.37	0.59	0.57	0.48
Wald statistic	125.45	92.34	99.02	180.12	156.28	120.67
Observations	490	490	490	490	490	490
Countries	22	22	22	22	22	22

* $p < 0.05$; ** $p < 0.01$

Notes: Standard errors in parentheses; Immigration is lagged one period (year); Services calculated as total of wholesale and retail trade, and other non-financial services; The dependent and GDP per capita variables are first differenced and measured in 2000 U.S. dollars; the coefficient of squared GDP per capita is multiplied by 100.

The results for Model 2 (columns 4-6 of Table 1) also indicate a negative and highly significant interaction between lagged immigration and the guest-worker country dummy for each of the three categories of services output. This provides further evidence that guest worker programs reduce the expansionary effect of immigration on services output, suggesting in the context of our theoretical model that such programs skew the mix of immigrants toward domestic-status workers. To examine if this negative indirect effect is large enough to offset the positive direct effect of lagged immigration on services

output we tested the hypothesis that the sum of the coefficients on the immigration variable and the guest-worker interaction variable is negative. This hypothesis was rejected at the 1% level for all three categories of services. In this context, the results for Model 2 in Table 1 indicate that in no case is the guest worker dummy significant and hence guest worker programs have no impact on the level of the change in services output across countries, suggesting that guest worker programs impact only the marginal effect of immigration on services output and not changes in the level of services output.

Finally, the estimates obtained for Model 2 indicate that the output elasticity (at data means) for each category of services with respect to a change in lagged immigration does not differ significantly from unity (point estimates: Total Services: 0.950; Other Services: 0.878; Wholesale Services: 0.999). However, a guest worker program substantially and significantly reduces each elasticity value by about 90% (point estimates: Total Services: 0.077; Other Services: 0.102; Wholesale Services: 0.059), suggesting the important impact such programs have for the expansionary effect of immigration.

3.3.2 Exports

Table 2 reports the results of estimating Models 1 and 2 for each of the three categories of exports. In all cases, the results indicate a positive and significant relationship between lagged immigration and exports, and hence that immigration and exports are complements in the data; a result consistent with the prediction of our theoretical model.[30]

30 Commentators on earlier versions of our paper questioned how internal migration among EU countries affect our results since a high fraction of immigrants to EU countries are EU nationals. Since many intra-EU migrants are, in the terminology of our model, domestic-status immigrants, a high fraction of such immigrants would make a substitute relationship between immigration and trade more likely. Our empirical finding of a complement relationship in the full sample of countries suggests that the presumed high faction of domestic-status immigrants is, other things equal, being offset by a small employment share of sector-specific immigrants in non-traded sectors.

Table 2: Regressions of exports on lagged immigration

Variable	Model 1			Model 2		
	(1)	(2)	(3)	(4)	(5)	(6)
	Goods and Services Exports	**Goods Exports**	**Services Exports**	**Goods and Services Exports**	**Goods Exports**	**Services Exports**
Immigration (lagged)	36.71**	26.67**	9.87**	36.54**	25.40**	11.28**
	(7.61)	(6.37)	(1.63)	(7.29)	(5.70)	(1.98)
Immigration (lagged) x Guest-worker dummy				-0.77	3.55	-5.68**
				(13.32)	(12.91)	(2.09)
Guest-worker dummy				-247.72	253.79	468.86
				(2444.88)	(2997.56)	(405.02)
GDP per capita	10.78**	9.87**	2.37**	11.01**	10.03**	2.46**
	(0.98)	(0.91)	(0.25)	(0.98)	(0.94)	(0.22)
GDP per capita squared	-0.19**	-0.21**	-0.02*	-0.20**	-0.22**	-0.03**
	(0.05)	(0.05)	(0.01)	(0.05)	(0.05)	(0.01)
Constant	-247.29	-227.74	-344.25*	-4533.14	-2527.86	-2221.05*
	(951.24)	(931.38)	(260.45)	(4395.78)	(4748.79)	(977.61)
R-Squared	0.29	0.25	0.33	0.30	0.25	0.36
Wald Statistic	146.15	145.18	108.13	154.29	146.73	142.23
Observations	503	434	434	503	434	434
Countries	22	20	20	22	20	20

* $p < 0.05$; ** $p < 0.01$

Notes: Standard errors in parentheses; Immigration is lagged one period (year); The dependent and GDP per capita variables are first differenced and measured in 2000 U.S. dollars; the coefficient of squared GDP per capita is multiplied by 100.

As to the impact of guest worker programs, the results for Model 2 in Table 2 indicate that in no case is the guest worker dummy significant and hence guest worker programs have no impact on the level of the change in exports across countries. Further, unlike the results for services output, the coefficient on the guest-worker interaction variable (columns 4-6 in Table 2) is negative and significant only for "Services Exports" This result is consistent with guest worker programs mainly directing workers into traded goods sectors (e.g., manufacturing) which then negatively impacts sectors producing *traded* services. For "Services Exports," we tested and rejected the hypothesis that the sum of the coeffi-

cients on the immigration variable and the guest-worker interaction variable is negative, indicating that the negative effect of a guest worker program is not large enough to offset the positive and significant direct effect of immigration on exports.

The estimates for Model 2 in Table 2 imply the following elasticity values (at data means) for exports with respect to a change in lagged immigration: Goods and Services Exports: 0.475; Goods Exports: 0.450; Services Exports; 0.643. For Services Exports, the elasticity value falls to 0.109 in the presence of guest worker programs. Comparing these elasticity values to those obtained for services output suggests that the effect on services output of an increase in lagged immigration is about double its effect on exports. The higher responsiveness of services output to increased immigration coupled with our finding that exports and lagged immigration are complementary is consistent with the predictions of our theoretical model, as is also consistent with Kohli's (2002) finding that an increase in non-native workers in Switzerland would substantially raise non-traded sector production but have a limited effect on export supply.

Finally, the results in both Tables 1 and 2 indicate that, in all cases, the coefficient on per capita GDP is positive and significant and the coefficient on squared GDP per capita is negative and significant. These results indicate that changes in GDP per capita have a positive but diminishing marginal effect on changes in exports and services output.[31]

4. Concluding Remarks

This paper has presented a model of a small open economy that produces two traded goods and one non-traded good using three factors of production, of which one is specific to the non-traded sector. The model's structure was intended to capture two empirical facts regarding immigrant labor. First, a high fraction of immigrant employment is concentrated in sectors producing non-traded goods. Second, some immigrants face significant and persistent barriers to mobility across sectors within their host country. In constructing a model that takes account of these aspects of immigrants and the nature of their employment, we have demonstrated that where immigrants work, and the characteristics of their employment, have important implications for the effect of immigration on a nation's pattern of

31 A time trend was initially included in each of our equations; in each case it was not statistically significant. Specific results are available from the authors.

production and trade. Importantly, our model allowed a given inflow of new immigrants to contain a heterogeneous mixture of foreign workers. In so doing, our model demonstrates that whether trade and international labor flows are substitutes or complements is not simply a result that arises, as in prior models, from specifying *a priori* the sector intensive in immigrant labor. Instead, our theoretical model indicated that the higher is the fraction of sector-specific immigrants among new immigrants, or the lower the existing employment share of sector-specific immigrants in the non-traded sector, the more likely that immigration will increase export sector production and decrease import-competing sector production, and hence increase trade.

Empirical examination of our model's predictions in a panel of OECD countries indicated strong support for the prediction that the output of (non-traded) services will rise with immigration. The results further indicated that trade and immigration are complements. Consistent with our model's predictions, this complementary relationship was found to be weakened by immigration policies, such as guest-worker programs, that target domestic-status type immigrants or direct the employment of immigrants into traded goods sectors. These findings suggest that it not only matters where immigrants become employed, but also from what country they arrive. If most immigrants arrive from countries with characteristics that allow for easier integration into the domestic labor pool (e.g., common languages), or that confer the skills needed to work in traded goods sectors, then the positive impact of immigration on the output of non-traded goods is reduced, and the more likely are trade and immigration to be substitutes.

Given this, our model has implications for targeted immigration policies, such as those that encourage high-skilled labor immigration or that target immigrants who are close substitutes for native workers. In particular, such targeting limits the potential for the complementary pro-trade effect that arises from the employment of sector-specific immigrants in non-traded goods sectors. However, we caution that these effects do not imply a country should limit rather than encourage particular types of immigrant workers or limit the integration of immigrants into the domestic labor pool since the implied sectoral output changes say nothing about national welfare,[32] which may be significantly enhanced by such integration, particularly when social dimensions are considered.

32 Felbermayr and Kohler (2007) consider welfare effects.

This paper's analysis demonstrates the importance of taking account of the sector and nature of immigrant employment as well as the heterogeneity of worker types in any new inflow of immigrants when considering the economy-wide impact of immigration. As to the limitations of our analysis and hence potential extensions, our model is static and therefore does not allow for dynamics such as the subsequent integration of sector-specific migrants into the domestic labor pool[33] and how this may in turn foster subsequent immigration, particularly of specific types of immigrants (e.g., sector-specific). The model also does not allow for other dynamics that may foster immigration and trade,[34] nor does it address possible endogenous links between trade and immigration.[35] All of this suggests that a further blending of the international trade literature with that focused on immigrant characteristics, and the ease to which immigrants are integrated into domestic labor markets, can offer further insights into the role and importance of immigrant heterogeneity and its impact on trade. In this regard, we hope that our model offers a framework for extensions that can offer both richer and more precise insights into the economic effects of immigration.

33 Falzoni et al. (2004) suggest that the job instability of migrants may fall the longer foreign workers remain in their host country, which implies that, over time, the pattern of non-native worker employment is more likely to match that of native workers and hence that a given cohort of non-native workers will become a closer substitute for native workers with similar qualifications.

34 For example, Hofmann and König (2006) argue that technology enhancements boost trade flows and increase immigration.

35 Such links are the focus of the "immigrant-trade link" literature (cf. footnote 11).

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