Economic and welfare effects of immigration policy: Lessons from the experience of Kuwait

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Abstract

Immigration has increasingly caused heated debates in many countries. Political populism has often given rise to anti-immigrant attitude among the public. Immigration policy decisions have often been based on perceptions and attitudes rather than evidences, specifically considerations of net benefits to the host country. The main objective of this study is to quantify economic impacts of immigration policy, focusing on economic and welfare consequences of reducing the size of immigrant labor. This is illustrated by using the case of Kuwait. The authorities have recently decided to reduce the size of immigrant population. This study set out with the aim of measuring consequences of reducing immigrant labor. A multi-sectoral and economy-wide model was utilized. The model was specified appropriately to capture most features of a segmented labor market. Simulation experiments were conducted in scenarios related to the existing policy, the proposed policy of reducing the number of immigrants, and mitigations required to minimize adverse impacts of the immigration policy reform. The focus was on macro-economy, sectoral and welfare and income distribution impacts. The results obtained indicated inevitable adverse economic and welfare impacts on natives unless the reduction in immigrant labor was accompanied with productivity enhancing policies.
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1. Introduction

Immigration has caused heated debates among policymakers and researchers alike. The attitude of natives toward immigrants have varied depending on the immigration model countries have historically adopted (Hagelund & Kjeldsen, 2021). Existing immigration policies can be classified into two broad categories.

The first one is the 'melting pot' model; immigrants settle in the host country with the prospect of becoming naturalized citizens. Canadian and Australian immigration policies are prime examples for this category. The second one is the 'guest workers' model, whereby immigrants are issued visa with fixed duration and possibility of renewals but no prospect for permanent settlement and naturalization for citizenship in the host country (Danzer & Yaman, 2016; Jurgens, 2010). The Gulf Cooperation Council (GCC) member countries have pursued this model, but this has precedence in many West European countries that allowed influx of unskilled labor in the 1950s and 1960s (Muller, 1999) and currently applied selectively, for instance, recruitments of foreign workforce for seasonal and temporary jobs in agriculture (Rickard, 2015).

Each immigration model has its own merit and drawbacks. For instance, European and US immigration policies allow permanent resettlement for those who already arrived but this is accompanied with strict legal barriers to forbid entry of new immigrants who often have resorted to illegal methods to reach their designations, traveling in harsh conditions for thousands of miles on land and across the seas (Facchini & Testa, 2021)). On the other hand, the GCC guest-worker model has a structured entry visa permission, creating job opportunities for millions of youth from poor countries, but residence of the immigrants is time bound; on the condition that they return to their home countries upon expiry of their visa permit (Al-Ubaydli, 2015).

Immigrants may have economic, social, and cultural impacts on the recipient communities. Positive aggregate economy-wide impacts of immigrants are often quantified using the notion of immigrant surplus (Hanson, 2009). Similarly, immigration has demographic impacts; it increases the size of the population of the recipient countries. More importantly, immigrants are often younger and economically active compared to natives; hence, it reduces dependency ratios (Gagnon, 2014). Additionally, immigrants arrive with skills that supplement the stock of human capital of the host country (Das, Marjit, & Kar, 2020).

The debate on adverse economic impacts of immigration have not yet been settled (Dustmann, Frattini, & Preston, 2012). For instance, displacement of natives in the labor market is often cited as one of the mechanisms through which immigration adversely affects native workers (Chassamboulli & Palivos, 2013; Moriconi, Peri, & Turati, 2022). However, country studies have shed some doubt on the existence of such adverse impacts (Portes, 2022, 2019; Ruhs & Vargas-Silva, 2020). Political debates are often driven by perceptions regarding social and cultural impacts that cause public antagonism towards immigrants (Al-Ubaydli, 2015).

This study focusses on quantifying economic impacts of immigration policy, using Kuwaiti data. Kuwait is a GCC member country that has adopted the 'guest worker' immigration policy for over half a century. By 1960, about two decades after Kuwait's oil discovery, immigrants reached more than half of Kuwait's resident population (United Nations, 2022) and then continuously rose to just over 70% in 2016. Kuwait's resident population was 4.67 million in 2020, 31% natives and 69% immigrants.

The considerably large share of immigrants in Kuwait's resident population has shifted public attention away from economic necessity to social and cultural concerns (Al-Fuzai, 2019; Moriconi et al., 2022). The issue has become source of heated debate among parliamentarians with emerging consensus and commitment to ameliorate the situation (Gulf Bank, 2020).

Kuwait's current national development plan has set an overambitious target to reduce number over the next decade (GSSPD, 2020).

The main objective of the study is to quantify economic impacts of the proposed change in Kuwait's immigration policy. The focus of the analysis will be on the macro-economy, sectoral and welfare and income distribution among natives. The study utilizes an economy-wide model, specified appropriately to capture features segmented labor market. Simulation experiments were conducted to assess economic impacts of the existing policy, the quantify economic consequences reducing the size of immigrants, and mitigation policies to minimize adverse impacts that might arise from reducing number of immigrants. The findings indicated that immigrants have positive economic and welfare impacts on host communities and reducing size of immigrants has adverse economic consequences. The Kuwaiti case study provided useful modeling approach to conduct policy simulations on segmented labor market conditions with differential wage differentials between primary and secondary markets.

The remaining parts of this paper is structured as follows. A conceptual framework for segmented labor market is discussed in the next section. This is followed by description of the model, baseline database, results, discussions and concluding remarks in that order.

2. Conceptual framework

The literature on economic benefits of immigration have often been broadly focused, comparing benefits to source and recipient country as well as benefits to immigrants and native workers in the recipient countries (Borjas, 1995; Chassamboulli & Peri, 2020; Hanson, 2009). The discussion here focusses on context of a segmented labor market, specifically, economic benefits to native employees and employers in the host country.

2.1. The immigrant surplus

Borjas (1995) pioneered an analytical framework to establish the fact that immigrants contribute more to national income more than they cost their employers. The increase in national income accruing to natives is termed as "immigrant surplus".

Fig. 1 presents relationships between the downward sloping labor demand (LD_0) and vertical labor supply (LS_0) curves. The horizontal axis (L) denotes the size of the labor force while the vertical axis denotes wage rate. The intersection point between LD_0 and LS_0 at e_0 yields equilibrium in the labor market with wage rate at W_0 and employment of natives at L_0. Immigration increases the labor force of the recipient country. This is expressed by the movement of the vertical labor supply from LS_0 to LS_1. A new labor market equilibrium is reached at e_1, with equilibrium wage at W_1. This means the size of the labor force increases from L_0 to L_1 and the wage rate falls from W_0 to W_1.

Now we examine consequences of immigration on the recipient country's economy. The comparative analysis of the movement from e_0 to e_1 is summarized as follows. Before immigration, producer surplus was given by A, labor income was the sum of areas B and C. The national income was the sum of the sum of producer surplus and labor income (A+B+C). After arrival of immigrants, producer surplus is given by the sum of areas A, B, and D. Similarly, labor income becomes C + E and national income A+B+C+D+E.

The change in producer surplus is B+D (=A+B+D – A). Similarly, the change in labor income is E-B [=C + E – (B + C)]. The overall change in national income was the sum of change in producer surplus and the change in labor income, which is equal to D+E (=B+D +E-B).
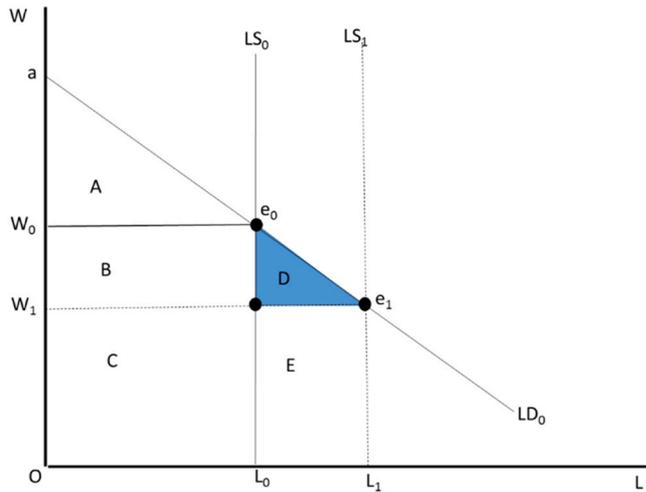
Fig. 1. The immigrant surplus.
(Adapted from Borjas, 1995, p. 7).

The comparative analysis in Fig. 1 involves redistribution of national income. For instance, B represents relocation of native labor income to producer surplus. It is reasonable to assume that immigrants arrive with no capital and that all business owners are natives, this means redistribution among natives. The other part of the increase in national income, E, represents wage paid to immigrants for their labor services. The shaded triangle, D, is referred to as "immigrant surplus". From the point of view of natives, there are losses by employees, B, and gains by producers, B+D. Therefore, D is a net gain to natives and this gain is made possible due to arrival of immigrants.

The effect of immigrant labor on wage of natives implies that natives and immigrants labor are homogenous and competitive. However, if the two labor categories are complementary than competitive, then the equilibrium wage does not necessarily fall.

The increase in national income (D + E) is likely to provide demand shock to the economy. This causes the demand line (LD) to move upwards to the right. The new demand line may intersect with LS_1 at a point that determines a new wage rate. The latter would certainly be higher than W_1 but might lie below, same level or above W_0 depending on the strength of the demand shock. The bottom line is that immigration may cause wage of natives to fall, remain the same or rise from the level before immigration.

2.2. Immigration and segmented labor market

Segmentation refers to division of the labor market into components that differ in contracts, working conditions and wage rates. These differences cannot be attributed to differences in productivity alone. The division of labor market between natives and immigrants is often studied using analytical framework developed for segmented labor market (Harris & Todaro, 1970).

Hanson (2009) extended the analytical frame developed by Borjas (1995) and applied it to the context of a segmented labor market, using the case of immigration of Mexican workers to the USA and focusing on relative economic gains and losses in each country. Fig. 2 is created

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Fig. 2. Segmented labor market.
(Adapted from Hanson, 2009, pp. 188–189).

by adopting analytical frameworks developed by Muller (1999) and Hanson (2009) but shifting the focus to economic impact of immigration on the recipient country and native workers.

The vertical axis, $O_N W$, measures wage rate, while the horizontal axis represents the size of the labor force. The relative sizes of natives and immigrant labor forces increase as we move from left to right (natives, O_N to J), and right to left [immigrants, $O_{M0}(O_{M1})$ to J], respectively. Initially, the sizes of natives and immigrant labor forces were N and M, respectively. Subsequently, it is assumed the number of immigrants increased by ΔM and the origin of the immigrant labor market space moved to O_{M1}.

Labor demand for the natives was given by LD_N. The intersection of LD_N with the vertical labor supply (LS_0) at e_0 yields an equilibrium at wage (W_N). Producer surplus and wage bill for natives are given by the areas of triangle $e_0 W_N A$ and rectangle $e_0 W_N O_N J$.

The initial immigrant labor demand is LD_{M0}. Its intersection with the vertical labor supply (LS_0) gives an equilibrium (e_{M0}) in the immigrant labor market with wage rate of W_{M0}. The market determined immigrant wage (W_{M0}) is lower than the institutionally determined native wage (W_N). The existence of immigrants in the economy generates additional producer surplus measured by the area of the triangle $e_{M0} W_{M0} B$. The immigrants receive a wage bill equivalent to area of the rectangle $e_{M0} W_{M0} O_{M0} J$.

Suppose the number of immigrants expanded to O_{M1}. The size of the immigrant labor force becomes $M + \Delta M$. Consequently, the size of the resident labor force becomes $N + M + \Delta M$. Given the institutional restrictions, the additional immigrant labor would not have any direct impact on equilibrium relationships in the native labor market, hence wage rate for natives and producer surplus corresponding to native labor market remains unchanged.

However, arrival of additional immigrant labor disturbs the immigrant labor market. The shift in the vertical line from O_{M0} to O_{M1} will cause immigrant wage rate to fall from W_{M0} to W_{M1}. The new equilibrium in immigrant labor market space would be reached at e_{M1} where a new immigrant labor demand line (LD_{M1}) intersects with the vertical labor supply line (LS_0).

The producer surplus corresponding with the newly established labor market equilibrium is given by the area of triangle $e_{M1}CW_{M1}$. Similarly, the wage bill going to immigrant labor becomes the area of the rectangle $e_{M1}W_{M1}O_{M1}J$.

Now it is possible to work out what happened to welfare of citizens. It is straightforward that the arrival of additional immigrant labor increases the producer surplus; the area of triangle $e_{M1}CW_{M1}$ is greater than of triangle $e_{M0}BW_{M0}$.

The fall in wage rate due to the arrival of new immigrant would reduce welfare of immigrants already resident in the recipient economy. The welfare of native population improves due to the induced demand related to additional income generated, labor income earned by the new immigrants and the additional producer surplus.

3. The model and the baseline data

This study applied a modified version of an existing computable general equilibrium (CGE) model previously developed and applied to Kuwait's economy. Gelan and Al-Awadhi (2022) and Gelan (2018) provide details of system of equations and full description of the model structure. In this paper we limit the model description to its diagrammatic exposition and variables definitions (Appendix A) and generic representations of nested structures of production and demand functions (Appendix B). The rest of model description is done in this section, combining it with description of the underlining database.

The underlying system of equations are transformed to a computable model by compiling the baseline database representing transactions and flows between institutions. This is accomplished by constructing a Social Accounting Matrix (SAM). Gelan et al. (2018) provides detailed discussion on the methodology for construction of SAM for Kuwait, which was subsequently updated to 2019 base year (Gelan & Al-Awadhi, 2022). This section briefly highlights the latest version, which is presented in condensed numerical format in Table 1, which has 22 by 22 dimensions. The accounts are denoted by acronyms, all described below the table. The corresponding account numbers are presented next to the row and column headings.

Accounts 1 and 2 represent commodity flows. PB_C and PR_C denote goods and services produced by public and private sectors, respectively. Entries in row cells record commodity demand by different institutional accounts while entries in their columns represent sources of commodity supply. The commodity demands come from intermediate demand by industries and household and government final demand, investment demand and exports. The sum of row entries gives total demand for commodity outputs by the two sectors. On the other hand, sources of commodity supply are domestic output and imports, including import taxes and product subsidies, respectively.

Accounts 3 and 4 represent industries classified by ownership types. In the condensed SAM, only two industries are presented. However, the full SAM used in the model had three producing sectors: two public (oil and non-oil sectors) and a private industry. There are only two entries in the rows of these accounts. The column entries start with intermediate demand for commodities (from accounts 1 and 2).

The remaining entries in the column, shaded in gray, represent value-added. These cover compensation for native employees, compensation for immigrant employees, and payment for capital services, and production taxes. The sum of these column entries yields total value of industrial output given as a row vector.

Income distributions to institutional groups are recorded in the other shaded block. In the condensed SAM, households are aggregated to two groups: natives (NHH) and immigrants

Table 1

Aggregate social accounting matrix for Kuwait for 2019 (millions of KD).

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		PB_C	PR_C	PB_A	PR_A	NL1	NL2	NL3	NL4	IL1	IL2	IL3	IL4	CAP	PTX	ITX	SUB	NHH	IHH	GVT	S-I	ROW	TOT
1	PB_C			6.3	0.7													2.1	3.5	10.4	0.3	20.1	43.5
2	PR_C			10.0	49.1													8.3	3.1		8.4	2.0	80.9
3	PB_A	44.9																					44.9
4	PR_A		63.6																				63.6
5	NL1			0.0	0.1																		0.1
6	NL2			3.0	0.7																		3.7
7	NL3			1.0	0.3																		1.3
8	NL4			3.8	0.1																		3.9
9	IL1			0.1	0.6													0.5	0.0				1.3
10	IL2			0.2	1.3													1.1	0.1				2.6
11	IL3			0.5	0.2																		0.7
12	IL4			1.1	0.9																		2.0
13	CAP			16.3	9.4																		25.7
14	PTAX			2.7	0.0																		2.7
15	ITAX	0.0	0.2																				0.2
16	SUBS	-2.8	0.0																				-2.8
17	NHH					0.1	3.7	1.3	3.9					6.3						4.4			19.6
18	IHH									0.8	1.7	0.7	2.0	1.1						3.2			9.6
19	GVT													18.3	2.7	0.2	-2.8	1.8	2.8			1.4	24.4
20	S-I																	5.7	0.0	6.4		-3.5	8.6
21	ROW	1.3	17.2							0.4	0.9												19.9
22	TOT	43.5	80.9	44.9	63.6	0.1	3.7	1.3	3.9	1.3	2.6	0.7	2.0	25.7	2.7	0.2	-2.8	19.6	9.6	24.4	8.6	19.9	

Source: compiled from Gelan et al (2018)

Descriptions of the SAM accounts:

PB_C: Public sector outputs	NL1: Skill type 1, native labor	IL1: Skill type 1, Immigrant labor	PTAX: Production tax	GVT: Government
PR_C: Private sector outputs	NL2: Skill type 2, native labor	IL2: Skill type 2, Immigrant labor	ITAX: Import tax	S-I: Saving-investment
PB_A: Public sector industries	NL3: Skill type 3, native labor	IL3: Skill type 3, Immigrant labor	SUBS: Product subsidies	ROW: Rest of the world
PR_A: Private sector industries	NL4: Skill type 4, native labor	IL4: Skill type 4, Immigrant labor	NHH: Native households	TOT: Total
		CAP: aggregate capital income	IHH: Immigrant households	

(IHH). In the full SAM used to implement the CGE model, each household group is divided into quintile income groups, ten household groups all together. Native households derive their come from native labor income and capital income, and government transfers. Immigrant household income comes from immigrant labor income, capital income and transfer from the government. The sum of household income is given as KD 29.2billion. The bulk of this goes to native households (67%). It follows that immigrants, who constitute two-third of Kuwait's population, earn the remaining proportion that is one third of total income generated.

A large proportion of government revenues comes from oil rent, recorded as capital income. The rest of government revenue comes from transfers from households and transfer from the rest of the world. Large proportion of savings comes from native households and government. As oil exporting and wealthy country, Kuwait has a sizable surplus of net savings, which is recorded as a balance with external sector.

4. Simulation results and discussions

4.1. Simulation scenarios

Simulation experiments were conducted in four scenarios.

Base Scenario: The model was run and the baseline values of all variables, as shown in the SAM, were replicated. In this scenario, the model run does not allow variations in the value of any exogenous variable. The results obtained served as a yardstick against which to measure changes in the remaining scenarios. This baseline run is labeled as "Base" in charts and tables presented in this section.

The labor supply of natives (QFS$_N$) and immigrants (QFS$_I$) were among exogenously treated variables in the model. In the remaining all simulation scenarios, QFS$_N$ was kept as exogenous as in the base scenario, QFS$_I$ could vary.

Scenario 1: The immigrant labor supply (QFS$_I$) was assumed to increase by 5%. This corresponds with the existing labor market condition where number of immigrants have been allowed to increase year on year.

Scenario 2: The immigrant labor supply (QFS$_I$) was assumed to decrease by 5%. This scenario is relevant to the ongoing policy debate on "population balancing", essentially reducing the size of immigrants and hence increasing the relative share of natives in the domestic labor market.

Scenario 3: As in scenario 2, immigrant labor was reduced by 5% but this was done in conjunction a 3% improvement in productivity of the factors of production. This would mean improvement in the productivity of native labor force, the remaining immigrant labor and that of capital. The improvement in productivity shock was applied by changing the efficiency parameter in the production function (discussed in Appendix A).

It is important to explain the motivation behind the combinations of shocks in Scenario 3. Given the importance of immigrant labor in Kuwait's economy, reducing immigrants would inevitably have adverse consequences on the economy. In other words, we expect scenario 2 to yield contractionary effects. For that reason, it was appropriate to explore options to mitigate adverse impacts of reducing the size of immigrant population.

4.2. Real GDP and welfare effects

The aggregate real GDP effect captures the notion of immigrant surplus discussed earlier (Borjas, 1995). The economic impacts of the simulation scenarios are classified into aggregate efficiency and equity outcomes. The real GDP effect captures the aggregate efficiency outcome of the corresponding simulation scenario (Fig. 3).

A 5% increase in the number of immigrants, with everything else remaining unchanged, caused Kuwait's GDP to increase by about 1%. Reducing the size of immigrant labor by 5% caused the size of the economy to contract by 0.51%. If the policy to reducing the size of immigrant population, by 5% is accompanied with a 3% improvement in productivity of the remaining factors of production, then GDP would rise from the baseline level by 0.25%.

It follows that reducing the size of immigrant labor would not necessarily cause adverse impact on the economy provided that the policy to reduce the immigrant labor is accompanied with some mitigation policies.

The welfare effect of the policy shocks was computed using the Atkinson index (Atkinson, 1970; Cowell, 1998). The equations, variables, and parameters involved in computing this index are defined in Appendix B.

The Atkinson index maps social welfare functions to income inequality. Social preferences and income inequality are mediated by an inequality aversion parameter ($\varepsilon > 0$). The lower the value of ε the lower the degree of inequality aversion, but "as ε rises, more weight is attached to transfers at the lower end of the distribution and less weight to transfers at the top and thus the level of inequality-aversion increases" (Neves & Pérez-Duarte, 2019. P. 12). That is to say, the aversion parameter is most sensitive to changes at the lower end of the income distribution.

The value of the Atkinson index ranges between 0 and 1 and it is positively related to the level of income inequality. The index itself is interpreted as "welfare equivalent equally distributed income". As indicated in the Atkinson index formula (presented in Appendix B),
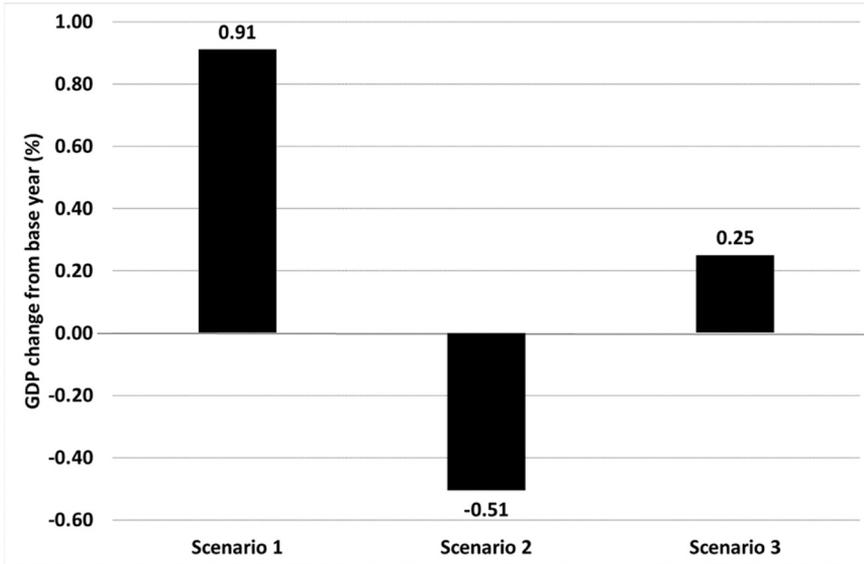
Fig. 3. Aggregate real GDP effects.

"welfare equivalent equally distributed income" is obtained by multiplying average income with one minus the Atkinson index.

This study is concerned primarily with welfare of native households. Accordingly, the indices displayed in Fig. 4 were computed based on income distribution among native
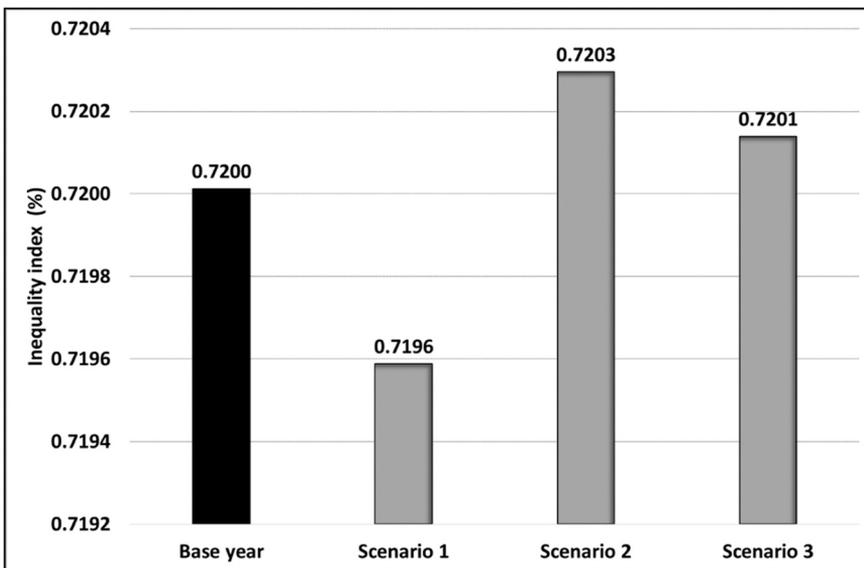

Fig. 4. Distributional effects on native households.

households, that is, relative positions of native households in the quintile distribution. An inequality aversion parameter of 0.3 was applied to compute the inequality indices for all scenarios.

The Atkinson index for the base year scenario was given as 0.72. The relatively high value of the Atkinson index confirms existence of high inequality among native households. If income was equally distributed among native household groups, then the same level of social welfare could be achieved with only 28% of the total income currently shared among native households.

Increase in the number of immigrant labor force (Scenario 1) means reduced inequality among native households. The finding in this section is consistent with the theoretical analysis in the earlier sections where it was established that increase in supply of immigrant labor positively contributes to welfare of native households (see Figs. 1 and 2). Inequality among native households worsens with a decrease in supply of immigrant labor.

4.3. Household income effects

Now we turn our attention to distributional issues. Income distribution was organized in quintiles, separately for natives and immigrant households.

The second column in Table 2 presents share of each quintile in total household income within each category. The top 20 natives received 32% of total household income allocated to natives, which was about three times the proportionate share of the bottom 20% households in the group. Similarly, income inequality among immigrant households is even worse, with 38% and 12% going to top 20% and bottom 20% respectively.

It proves useful to explain the extent to which change in immigration would affect income of households in different income and nationality groups that is the distributional effects (Borjas, Freeman, & Katz, 1997; Borjas, 1995).

In scenario 1, the positive aggregate GDP effect translated to positive household income effect. Accordingly, native and immigrant household income rose by 0.33% and 1.09% respectively. Immigrant household income rose for two reasons: employment income of the new immigrant households and additional income earned by existing immigrant households. The native household income rose due to positive stimulus to the economy triggered by additional

Table 2
Household income effects.

	Base year	Change from base year (%)		
	Share (%)	Scenario 1	Scenario 2	Scenario 3
Native households	**100**	0.33	-0.55	0.12
Quintile 1	**11**	0.59	-0.91	0.29
Quintile 2	**15**	0.55	-0.86	0.25
Quintile 3	**19**	0.46	-0.72	0.20
Quintile 4	**22**	0.17	-0.32	0.02
Quintile 5	**32**	0.17	-0.31	0.02
Immigrant households	**100**	1.09	-1.79	0.24
Quintile 1	**12**	0.51	-0.88	0.02
Quintile 2	**15**	1.22	-2.09	0.16
Quintile 3	**16**	0.96	-1.65	0.14
Quintile 4	**18**	1.17	-1.88	0.28
Quintile 5	**38**	1.26	-1.98	0.36

immigrant labor supply. In this scenario, native households in lower quintile experienced relatively larger increases in their income than those in the higher quintiles. The effect on income distribution among immigrant households is mixed, the bottom 20% and top 20% experiencing lower and higher proportionate increases while those in between experiencing mixed effects.

Scenario 2 results confirmed that decrease in immigrant labor yielded contrasting results with those in scenario 1. Total income of native and immigrant households declined by 0.55% and 1.79% respectively. Income inequality worsened among natives as well as immigrant households.

Scenario 3 displays patterns of changes closely related to Scenario 2, both in terms of changes in levels from the baseline and income inequality effects. Results obtained in this scenario were net outcomes from contractionary effects of reduced immigrant labor supply (as in scenario 2) and expansionary effects of factor productivity improvements introduced as a mechanism to mitigate adverse impacts emanating from possible changes in immigration policy.

4.4. Sectoral employment effects

This section presents sectoral employment effects of the different immigration shock scenarios. Interpreting and explaining the underlying industry and skill effects of the simulation shocks were not as straightforward those related to aggregate GDP and welfare effects.

Kuwait's segmentation of the labor market is primarily manifested through high degree of concentration of the native labor force in the public sectors and the immigrant labor in the private sector. The sectoral shares in employment is reproduced in column 2 of Table 3.

Increase in immigrant labor supply (Scenario 1) resulted in a shift in employment away from the public to the private sector. Inter industry employment relocation effect was accompanied with a shift in the skill composition in favor of higher skill types both in public and private industries.

Interpreting these results requires looking back to the specification of the model applied to conduct the simulation experiment, more specifically the relationships in the nested production function (Appendix A.1) and the model closure rules. The nested production function allows for substitution between native and immigrant labor of similar skill types. However, the substitution possibility is restricted by two factors.

The first one is the size of the substitution elasticity parameter. Although substitution was allowed, this was implemented by apply relatively low substitution parameter in the inelastic range (0.6). This means the possibility of substituting immigrant for native labor is low, regardless of changes in labor market conditions (changes in supply and wage).

The second is the model closure rules, which excluded the possibility of open unemployment for the native labor, given the guarantee of full employment to citizens in Kuwait. The other rules were that wages paid to natives is not flexible, regardless of labor market conditions. The model allows inter-industry mobility of native workforce and possibility of moving between public and private sectors. Fixed labor market condition was assumed for native labor: fixed wages and fixed total labor supply. Flexible labor market condition was assumed for immigrant labor and wage rates are market determined. Both natives and immigrants were mobile between industries.

Simulation results obtained in this scenario 2 sharply contrasted with those obtained under scenario 1. The contrasts are consistent in terms of differential impacts on public and private industries as well as effects on the skill composition of the employed labor force. The

Table 3
Sectoral employment effects.

	Base year Share (%)	Change from base year (%)		
		Scenario 1	Scenario 2	Scenario 3
Publicly owned - oil	**2.5**	**0.1**	**2.1**	**5.2**
Natives	**2.0**	**-0.1**	**2.4**	**5.7**
Least skilled (type 1)	0.0	-2.6	3.6	5.4
Skill type 2	1.3	-0.4	2.6	5.8
Skill type 3	0.3	-0.5	2.8	6.0
Most skilled (type 4)	0.3	1.8	1.2	5.2
Immigrants	**0.5**	**1.0**	**0.5**	**3.0**
Least skilled (type 1)	0.1	0.2	0.1	1.5
Skill type 2	0.3	0.2	1.3	3.8
Skill type 3	0.0	3.2	-1.1	2.1
Most skilled (type 4)	0.1	2.7	-0.7	2.4
Publicly owned - non-oil	**23.6**	**-0.8**	**0.0**	**-0.7**
Natives	**15.4**	**-1.3**	**0.8**	**0.2**
Least skilled (type 1)	0.1	-3.8	2.8	1.8
Skill type 2	5.5	-2.4	1.5	0.4
Skill type 3	1.6	-2.5	1.6	0.7
Most skilled (type 4)	8.1	-0.3	0.1	-0.1
Immigrants	**8.2**	**0.0**	**-1.3**	**-2.4**
Least skilled (type 1)	0.9	-1.0	-0.7	-2.0
Skill type 2	1.7	-1.8	0.2	-1.4
Skill type 3	1.7	1.1	-2.2	-3.0
Most skilled (type 4)	3.9	0.6	-1.8	-2.8
Privately owned	**44.1**	**6.0**	**-5.7**	**-5.5**
Natives	**3.8**	**5.3**	**-4.5**	**-3.7**
Least skilled (type 1)	0.2	2.4	-1.9	-1.5
Skill type 2	2.6	5.4	-4.6	-3.9
Skill type 3	0.8	5.3	-4.5	-3.7
Most skilled (type 4)	0.2	7.7	-5.9	-4.4
Immigrants	**40.3**	**6.1**	**-5.8**	**-5.6**
Least skilled (type 1)	21.1	5.3	-5.2	-5.2
Skill type 2	12.8	6.0	-5.8	-5.7
Skill type 3	1.6	9.2	-8.1	-7.2
Most skilled (type 4)	4.8	8.6	-7.7	-7.0
Private households	**29.9**	**5.0**	**-5.0**	**-5.0**
Native households	**28.2**	**4.9**	**-5.0**	**-5.0**
Immigrants - skill type 1	16.9	4.9	-5.0	-5.0
Immigrants - skill type 2	11.3	4.9	-5.0	-5.0
Immigrant households	**1.7**	**5.9**	**-5.5**	**-5.3**
Immigrants - skill type 1	1.0	5.9	-5.5	-5.3
Immigrants - skill type 2	0.7	5.9	-5.5	-5.3

interpretations made for scenario 1 would apply to this scenario as well except that the logical explanations follow in the opposite direction.

It is important to reiterate important policy implications indicated under scenario 3. Kuwait's economy has evolved utilizing considerably large immigrant labor. Reduction in immigrant labor would adversely affect the economy. Kuwait's population balancing policy would need to be designed with due care, ensuring that productivity of the remaining labor force (natives as

well as the remaining immigrant labor) should be enhanced to make up for inevitable loss in output due to departure of immigrant labor.

5. Discussions

This section broadens the scope of interpretation of the findings, relating them to those obtained from empirical studies on other countries. The positive welfare and macroeconomic stimulus on host economies has widely been reported in the theoretical and empirical literature on immigration.

Regarding welfare impacts of immigration, other studies support the finding that unskilled foreign workers entering the secondary labor market increases aggregate welfare in the host economy, although entry of skilled foreign workers into the primary labor market may not necessarily lead to positive contributions to overall welfare (Fuest & Thum, 2000; Gaston & Rajaguru, 2013; Shimada, 2005). The explanation for this outcome follows from the fact that unskilled workers being mostly complementary while skilled immigrants are likely to be competitive to the native labor force, as discussed earlier. The positive welfare impact reported in the results in the current study comes from the fact that considerably large proportion of immigrants to Kuwait are unskilled immigrants.

Regarding aggregate GDP and income effects, Chassamboulli and Peri (2020) and Chassamboulli and Palivos (2013) have conducted in depth empirical studies on the USA, finding that skilled and unskilled immigrants generate larger economic surplus to US business than natives do.

Weyerbrock (1995) examined economic impacts of immigration in European Union during the years immediately after EU expanded to East Europe. The study was conducted using CGE modeling approach whose specifications is analogous to the scenario 1 in the current study. Weyerbrock found that EU member countries wage regimes influenced the macroeconomic effects of immigration. If cases where real wage was fixed and size of capital was mobile across sectors, then the impact of immigrants on EU's economy were 0.15% and 0.17% increases in real GDP and real household income, respectively. On the other hand, flexible wage with mobile capital caused larger aggregate economic impacts, increases by 1.5% and 1.93% real GDP and real household income, respectively.

The segmented labor market model applied in this study was specified with fixed wage (native labor) and flexible wage (immigrants), capital was mobile across sectors (see Section 4.4). Accordingly, the real GDP effect of 5% increase in immigrants was 0.91%, which falls between Weyerbrock's fixed and flexible wage scenarios. Similarly, the household income effects in this study were 0.33% (native household) and 1.09% (immigrant households). It follows that the aggregate results obtained in this study are close to those reported in Weyerbrock (1995), in spite of substantial gaps in the study contexts, both in space and time.

Portes (2022) reviewed several studies on Brexit, which caused departures of large number of European immigrants from the UK. The economic impact of immigrants departing from UK caused GDP contraction which ranged between 0.2% and 1.9%. These variations in the estimates of GDP impacts depended on the number of immigrants estimated to depart, which ranged from 200,000 thousand to 600,000. The results Portes (2022) summarized in their study support the findings reported under scenario 2 of this study.

The brief discussion in the preceding paragraphs indicated that the finding from the Kuwait case study has generated evidence that corroborate those obtained from other case studies from large countries. As a matter of fact the Kuwait specific study is highly policy relevant in that it provided insights into such dimensions as the roles of segmented labor market, specifically the critical role of wage setting conditions in determining the macroeconomic impacts of immigration.

6. Conclusions

This primary purpose of this paper was to examine economic and welfare effects of immigration policies. Simulation experiment were conducted by applying a computable general equilibrium model. The model was run in three immigration policy scenarios.

The first scenario quantified the impacts of a 5% increase in the size of immigrant the economy of the host country. In the second scenario, the size of immigrant labor was reduced by 5% to measure possible economy-wide consequences of anti-immigration policies that may translate to reduction in the size of immigrant labor. The third scenario is concerned with mitigation measures to deal with reduction in immigrant labor. This was implemented by applying simultaneous shocks of a 5% reduction in the immigrant labor supply and a 3% efficiency improvement.

Increase in the size of immigrant labor force has led to increase aggregate GDP and welfare. This finding is consistent with the theoretical and empirical findings in the literature. Theoretically, the notion of immigrant surplus hinged on the fact that additional immigrants make net contribution to the economy. The findings indicate that immigrant labor does not only contribute to improvements in aggregate welfare of native households but also it reduces income inequality. The simulation results have also revealed sector specific effects. Proportionately larger employment change occurred in the private sector than in the public sectors.

Reduction in the size of the immigrant labor was simulated to examine consequences of anti-immigration rhetoric that often end up with policies to reduce immigrant labor. The results obtained indicated that reducing immigrant labor indeed have adverse outcomes in terms of deteriorations macroeconomic and welfare losses. An additional simulation run was conducted to illustrate policy options to minimize the adverse impacts related to reductions in of immigrant labor. For this, an improvement in efficiency shock was applied in conjunction with reduction in immigrant labor. This reduced the extents of adverse macroeconomic and welfare impacts. The efficiency shock was meant to measure productivity improvement, for instance, enhancing skills of natives and the remaining immigrants.

A brief review of empirical literate indicated that the findings of this study are supported by those obtained in other country studies. The current study has made modest contribution to the literature, particularly enhancing understanding of economic impacts of immigration in countries characterized by dual labor markets and segmented wage setting conditions.

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Appendix A. Structure of the model

Gelan and Al-Awadhi (2022), Appendix B, provides further details of the system of equations applied in CGE model used in this paper. This appendix provides a diagrammatic exposition of the model. The structure of production and demand are presented in Figs. A.1 and A.2 respectively. Indices, parameters, and variables shown in the diagrams are defined. This is followed mathematical interpretations of the nested relationships displayed in Figures are discussed.
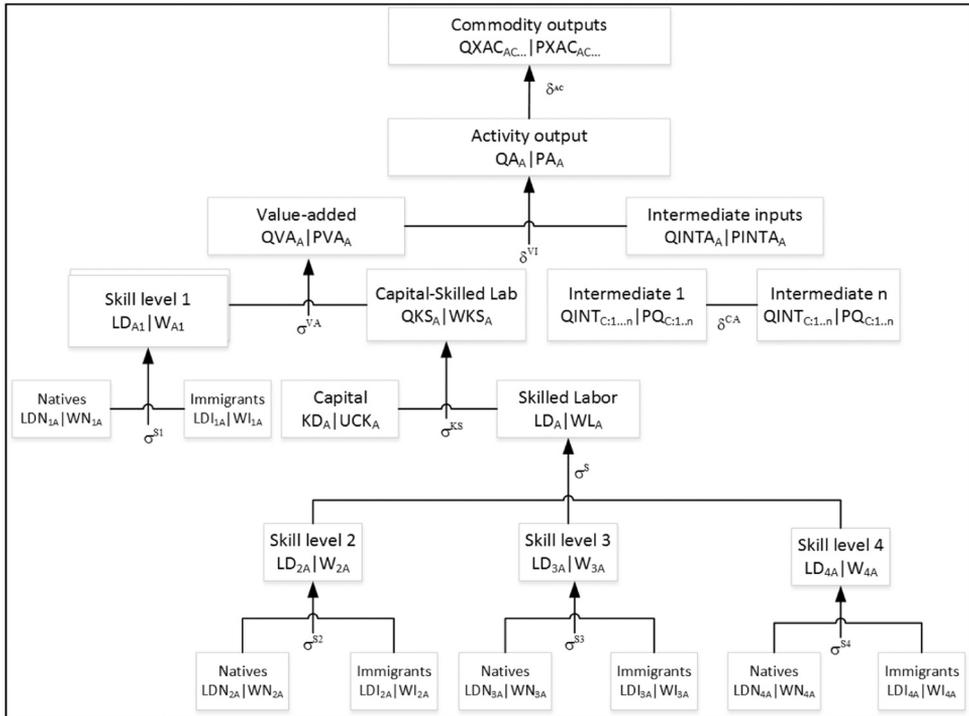

Fig. A. 1. Structure of production.
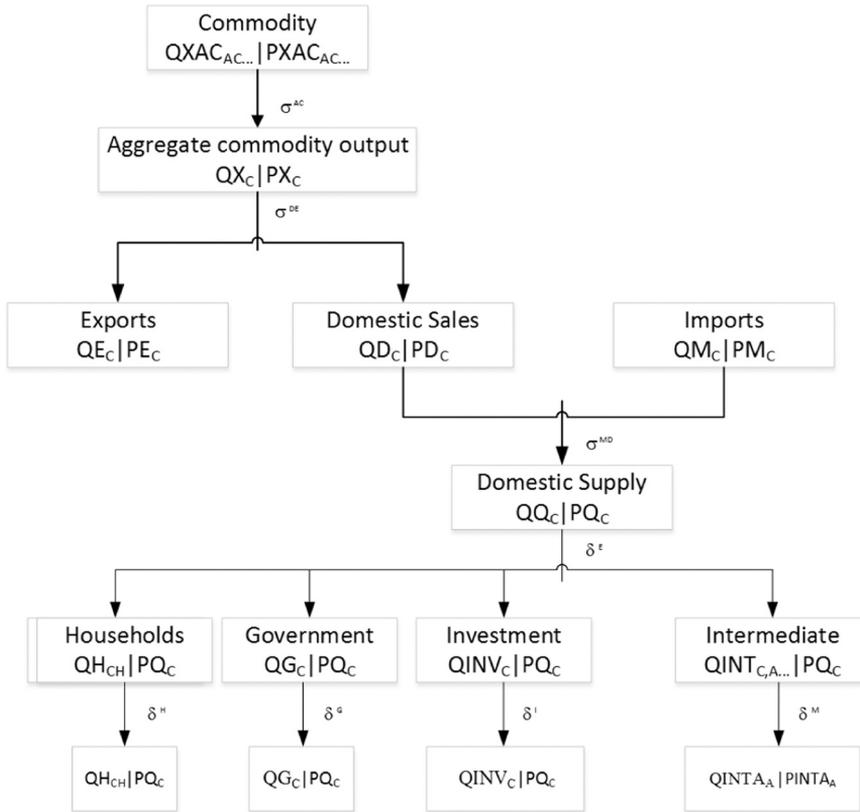
Fig. A. 2. Structure of demand.

Definitions of indices, parameters and variables

Subscripts

A   Industries
C   Commodities
H   Households
1,2,3,4   Skill types (1–4)

Parameters

σ   Constant elasticity of substitution transformation) (CES/CET)
δ   Leontief aggregation

Wages

W   Average national wage
WI   Average wage of immigrants by skills
WL   Native-immigrants composite price of skilled labor

WN   Average wage of natives by skill types

Prices
PA   Price of activity output
PD   Domestic price
PE   Export price
PINTA   Composite price of intermediate inputs
PM   Import price
PQ   Commodity price
PVA   Price of value-added
PXAC   Price of activity out A of commodity C
UCK   User cost of capital
WKS   Composite price of labor and capital

Quantities
KD   Capital demand
LD   Aggregate labor demand
LDI   Number of immigrants employed
LDN   Number of natives employed
QA   Aggregate industry output
QD   Domestic supply
QE   Exports
QG   Government final consumption
QH   Household final consumption
QINT   Quantities of intermediate inputs
QINTA   Composite quantity of intermediate inputs
QINV   Investment demand
QKS   Capital-labor composite
QM   Imports
QQ   Total domestic supply of commodities
QVA   Value-added composite
QX   Aggregate commodity output
QXAC   Quantity of commodity C produced by activity A

Appendix B. Nested functions

B.1. CES functional form

In Figs. A.1 and A.2, all nests of the production function (including commodity production and supply) were denoted by C. This stands for the CES functional form which takes the following mathematical form.

$$QZ = A_i^e \left(\delta_x QX^{-\rho} + \delta_x QY^{-\rho}\right)^{\frac{-1}{\rho}} \tag{A.1}$$

QZ: quantity of the composite or aggregate variable.

QX, QY: quantity demanded of the first and second variables that constitute QZ.

δ_x, δ_y: share of QX, QY, respectively, in QZ.

ρ: exponent of the CES function where, $\rho = \frac{1-\sigma}{\sigma}$, and σ is elasticity of substitution between the two inputs.

Demand for the inputs QX, QY are given as:

$$QX = \delta_x^\sigma \left(\frac{PZ}{PX}\right)^\sigma QZ \tag{A.2}$$

$$QY = \delta_y^\sigma \left(\frac{PZ}{PY}\right)^\sigma QZ \tag{A.3}$$

where

PZ: composite price.

PX, PY: prices of QX and QY.

The relationships between prices are given as:

$$PZ^*QZ = PX^*QX + PY^*QY \tag{A.4}$$

The share parameters are calibrated to the baseline data using the following relationships

$$\delta_x = \frac{PX^*QX^{1+\rho}}{PX^*QX^{1+\rho} + PY^*QY^{1+\rho}} \tag{A.5}$$

$$\delta_Y = \frac{PY^*QY^{1+\rho}}{PX^*QX^{1+\rho} + PY^*QY^{1+\rho}} \tag{A.6}$$

B.2. CET functional form

The symbol CT denoted the Constant Elasticity of Transformation (CET). This takes the following functional form. This appeared only once in Fig. A.1, representing transformation of domestic output into exports and local supply.

The CET function takes the following form:

$$QP = A_C \quad (\theta_d QD^\varepsilon + \theta_e QE^\varepsilon)^{\frac{1}{\varepsilon}} \tag{A.7}$$

where,

QP: quantity of commodity output.

QD, QE: Quantity supplied to local and external markets, respectively.

θ_d, θ_e: share of QD, QE, respectively, in QP.

ε: exponent of the CET function where, $\varepsilon = \frac{1+\gamma}{\gamma}$, and γ is elasticity of substitution between the two inputs.

Commodity supply to domestic and export markets QD, QE are given as:

$$QD = \theta_d^{-\gamma} \left(\frac{PD}{PP}\right)^\gamma QP \tag{A.8}$$

$$QE = \theta_e^{-\gamma} \left(\frac{PE}{PP}\right)^\gamma QP \tag{A.9}$$

where

　PP: composite supply price.

　PD, PE: domestic sales and export prices.

　The relationships between supply prices are given as:

$$PP*XP = PD*QD + PE*QE \tag{A.10}$$

The share parameters are calibrated to the baseline data using the following relationships

$$\theta_d = \frac{PD*QD^{1-\varepsilon}}{PD*QD^{1-\varepsilon} + PE*QE^{1-\varepsilon}} \tag{A.11}$$

$$\theta_e = \frac{PE*QE^{1-\varepsilon}}{PD*QD^{1-\varepsilon} + PE*QE^{1-\varepsilon}} \tag{A.12}$$

Appendix C. Atkinson index

　The Atkinson index measures "the amount of social utility to be gained by complete re-distribution of a given income distribution, for a given inequality aversion parameter. Thus, the Atkinson index gives the share of current income which could be sacrificed, without reducing social welfare, if perfect inequality were instated" (Neves & Pérez-Duarte, 2019, p. 11). The interpretation of the Atkinson index is adapted to the context of this paper. The Atkinson index can be interpreted as:

$$Atk(\varepsilon) = 1 - \frac{1}{\bar{y}}\left(\frac{1}{n}\sum_{h=1}^{n} y_h^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}}$$

　ε = the Atkinson inequality aversion parameter ($0 \le \varepsilon \le 1$).

　n = number of native households.

　$\bar{y}$ = average native household income.

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