Remittances Inflow and Export in Developing Countries

Use Emigrants as a novel IV

Sirui Bi

Abstract

Remittances inflow is the money sent back by the workers working in other countries, being a vital component of developing countries' economic growth over a decade. The motivation of this paper comes from the ambiguity of the relationship between remittances inflow and export in previous literature. This paper analyzes the impact of remittances inflow on export performance of 118 middle-income and low-income countries using annual data from 2010 to 2019. This paper applies emigration predicted by net migration as an novel instrumental variable in a panel dataset with two fixed effects. With certain controls, increase in remittances inflow leads to significant increase in export. However, there is insignificance when controlling GDP per capita. The endogeneity comes from factors including export elasticity, trade openness, and industry capacity.

Keywords: Remittances inflow; Export; Panel Data

1 Introduction

Remittances inflow is the money sent back by the workers working in other countries. According to IMF, remittances inflow is nearly 6 percent of GDP for low-income countries, and about 2 percent of GDP for middle-income countries. In theory, remittances inflow increases the money supply and domestic price, thus decreases the competitiveness of export (Vardanyan, 2019). In practice, the relationship of remittances inflow and export is ambiguous since export elasticity, trade openness, and industry capacity etc. will affect export oppositely (Beja and Edsel, 2011). This paper aims to empirically examine if remittances inflow is associated with deterioration or elevation of export in developing countries using a novel instrumental variable.

Large data available for all developing countries provide complete panel data with countries' ID and year as two fixed effects. This helps to isolate unobserved time-invariant country-specific characteristics. First, I use net migration to predict emigration. Second, I adopt emigrants as an instrumental variable since emigrants pass IV assumptions. Then, I add several control variables, including life expectancy, unemployment, and GDP per capita, and compare the results using IV regression with OLS regression.

This paper claims that increase of remittances inflow leads to increase of export, which deviates from theoretical intuition where remittances inflows exacerbate export. Even though this paper includes three main control variables, there are still endogeneity concerns which come from the assumptions of this paper. First, this paper assumes all the exported goods are homogeneity, which means the elasticity of exported goods[1] are the same. However, in reality, some types of products are relatively not affected by appreciation shocks such as exchange rate or money supply fluctuations. (Vardanyan, 2019). Second, this paper ignores exchange rate since previous literature has ambiguous or insignificant conclusion of exchange rate. However, in reality, real exchange rate volatility can generate endogeneity since real exchange rate is correlated with export and remittances inflow. Third, this paper only includes three control variables to avoid overfitting problem. However, other confounders such as trade openness and migration policies affect the availability to trade and remittances transaction in reality. Moreover, industry capacity disturbs employment and wages in labor intensive or capital intensive markets and restricts certain exported goods. Fourth, this paper assumes IV exclusion assumption holds, which means emigrants as an IV has no correlation with error term. The exclusion assumption comes from economic intuition which can be proved qualitatively but cannot be tested quantitatively.

Assumptions

1. The elasticity of exported goods are the same.
2. Not consider exchange rate.
3. Only include three control variables to avoid overfitting.
4. IV exclusion assumption holds.

[1]Elasticity of exported goods means the sensitivity of export with respect to economic fluctuations.

2 literature review

In theory, remittances receiving has a statistically significant negative impact on export, the higher net inflow of remittances which appreciates the currency of the recipient country implying harm of export (eg. Paudel and Bhusal 2021; Ito 2017; Vardanyan 2019). In reality, there are a few studies focused on the negative relationship of remittances and export based on different emerging economies such as Philippines (Bayngos and Jansen 2011), Bangladesh (Chowdhury and Rabbi 2014), Pakistan (Shamim, et al. 2015), and South Asian countries (Jena and Sethi 2020).

However, Kandil and Mirzaie (2008) states the positive correlation of remittances in export in Tunisia, even though Jordan and Egypt in the same study still remain the negative correlation. Ito (2017) also finds the magnitude of export decline generated by remittances receiving in Moldova is small, even though the real exchange rate appreciates. According to Beja and Edsel (2011), exchange rates, trade openness, improvement in labor, and industrial capacity are possible factors to afflict developing countries more than developed countries. Even though the factors are not subject to reverse causality (Giuliano and Arranz 2008), and there are existing instruments for financial development, such as origins of a country's legal system and creditor rights (La Porta et al. 1997) and distance from the country of origin (Rajan and Subramanian 2005), these IVs do not vary over time. Given the large available data for 118 developing countries from 2010 to 2019, I generate a panel dataset to eliminate confounders varying by countries and years, so time-varied IV is vital in this paper. Thus, I propose a novel IV following Gruber (2020) and Tam (2009) and compare IV regression with OLS estimation following a similar approach as Giuliano and Ruiz-Arranz (2008) and but with an updated time period (2010-2019) and 118 middle class economies.

I control Unemployment, life expectancy, and GDP per capita. Considering unemployment, Janeba (2009) states that unemployment affects export via foreign direct investment from the perspective of labor mobility, industrial integration, and globalization. Gaston and Rajaguru (2012) also argues that exports' prices affect unemployment in a small open economy model. In addition, increase of unemployment causes personal income decrease and then exacerbate remittances inflow for developing countries. Considering life expectancy, Hansen (2013) claims

that the rise in life expectancy increases human capital investments, leading to endogeneity to economic development and then affect export (Bloom et al., 2013). In addition, Bhargava et al. (2001) finds positive effects of adults' survival rate on GDP growth rates in low-income countries. Moreover, Kotschy (2021) states that there is a causal link between health and income per person, and health dynamics shape life-cycle incomes which affects remittances inflow. Considering GDP per capita, Imai et al. (2014) and Batu (2017) argues temporary remittances inflow has positive causality with GDP per capita. However, Hor (2017) finds negative impact of GDP per capita on remittances inflow. Also, export affects GDP per capita and there is reverse causality according to Sunde and Ogbokor (2018). Thus, I control Unemployment, life expectancy, and GDP per capita as three control variables to reduce endogeneity.

Note that regarding impact of exchange rate, Brahim, Nefzi and Sambo (2017); Mongardini and Rayner (2009); Rajan and Subramanian (2005) conclude that remittances have negative or no impact on real exchange rate. However, Lopez, Molina and Bussolo (2007); Acosta, Lartey and K.K.Lartey (2009); Amuedo-Dorantes and Pozo (2004) support the appreciation hypothesis. Since the relationship of exchange rate and remittances is ambiguous and generates endogeneity and collinearity problems, I ignore exchange rate in this paper to find the relationship solely between export and remittances inflow directly.

3 Data

I use cross-national annual data for 118 developing countries over 2010-2019 from the World Bank, chosen because of data availability and to avoid the 2008 financial crisis and covid-19 pandemic. The dataset includes 52 upper-middle income, 40 lower-middle income and 26 low-income countries.[2]

- Exports of goods and services in current USD, used as the dependent variable;
- Remittances inflow in current USD, used as an independent variable;
- Emigrants predicted by net migration (population), used as an instrumental variable;
- Unemployment (percentage of total labour force), used as a control variable;

[2]See the list of 118 countries in appendix.

• Life expectancy measured in years, used as a control variable;

• GDP per capita (in 2015 USD), used as a control variable.

Table 1: Data Summary

	Logarithm applied to all variables			
	mean	sd	min	max
Export	20.02785	2.155959	12.22955	25.1461
Remmitances	22.91424	2.075363	18.06895	27.22418
Emigrants(Predicted)	1.756688	1.12752	-.6167886	4.109385
Unemployment	1.797417	.8730735	-1.966113	3.466361
Life Expectancy	4.235747	.113493	3.829054	4.432731
GDP per Capita	8.234096	1.305031	5.59893	12.16104
N	1180			

Notes: Columns 1-4 report the mean, standard deviation, minimum, and maximum of the named variable by countries and years according to the World Bank. Emigrants data is predicted and assembled using net migration data from 2010 to 2019 and available emigrants data in 2010 and 2015. Values in the table are standardized by logarithm.

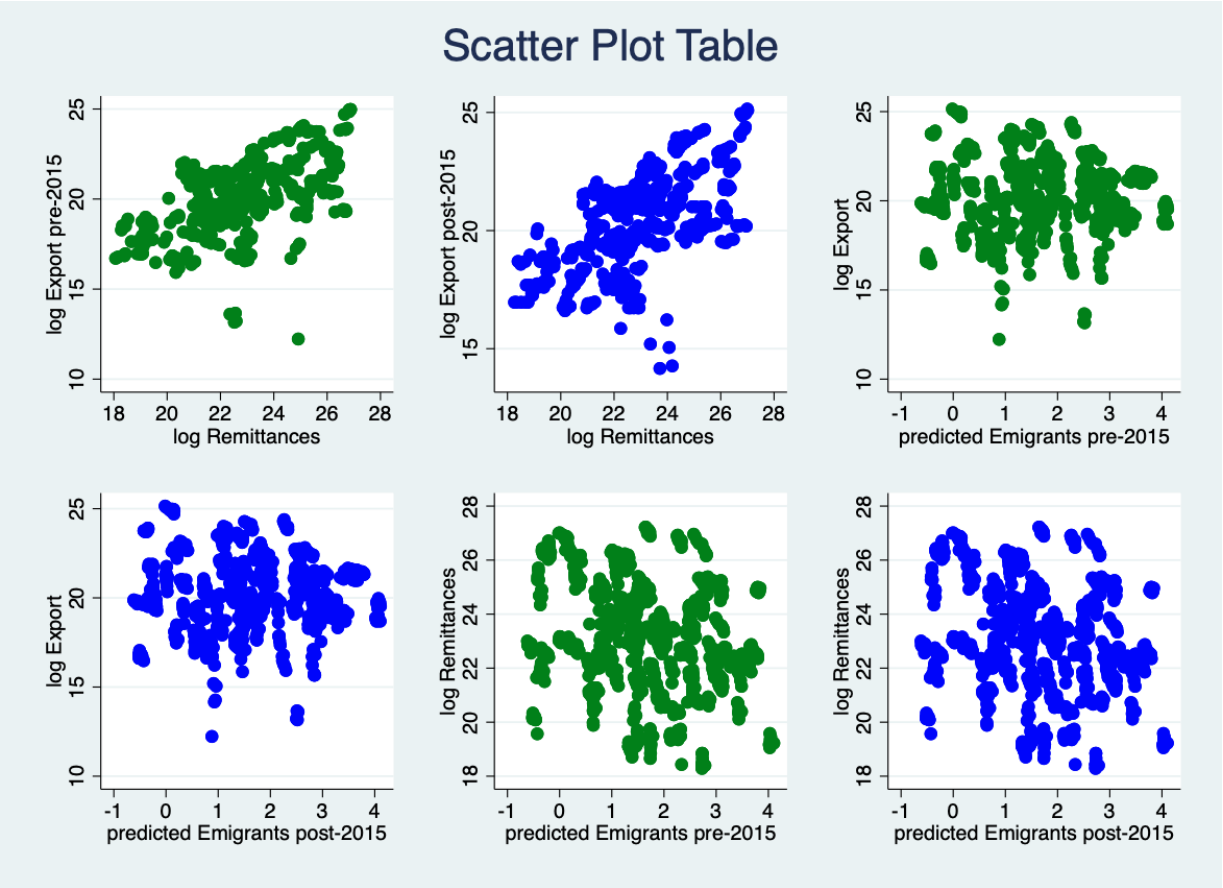
This paper applies logarithm to all the variables to adjust the skewness of data. The data summary table with 1180 observations shows that the standard deviation is reasonable and there is no extreme value. In addition, emigrants used as a novel IV is the people move abroad. Since the only available data for emigrants is in 2010 and 2015, we use net migration which includes all the data from 2010 to 2019 to predict emigrants for all years.[3] Even though the correlation of net migration and emigrants is not significant, we can still adopt the prediction according to Gelman (2011).

Emigrants in population is a potential IV with the following economic intuition. First, an essential part of remittances inflow originates from emigrants, so emigrants are likely to pass IV relevance test[4]. Second, emigrants data varies by countries and years, so it follows the format of panel data in this paper. Since this paper uses two fixed effects in a panel dataset, being a powerful tool to cross out some country-specific and time-specific bias, time-varied IV is crucial in this paper. To further verify the usefulness of cluster countries' ID, the following scatter plot table shows the relationship without the two fixed effect. The three graphs in the first row show the main regression, first stage and reduced form before 2015. The three graphs in the

[3]This paper uses linear regression to generate prediction. Even though further researches can adopt advanced algorithm such as Kalman filtering to predict emigrants, this paper does not discuss the accuracy of prediction.

[4]IV relevance test requires IV has significant correlation with independent variable

second row shows the scatter plots after 2015. Even though the scatter plot groups the data by time period, it is hard to see the significant relationship. Thus, this paper clusters countries' ID which reduces the country-specific bias.



Third, this paper assumes emigrants passes IV exclusion test since emigrants is not likely to have significant correlation with error term where most endogeneity problems come from. This paper argues that emigrants in population is more likely to be independent from confounders which affect employment and remittances inflow since the definition of emigrants, labor force, employed workers, and remittances senders are different. On one hand, some of emigrants are unemployed or don't belong to the labor force. On the other hand, emigrants may decide size of remittances according to the exchange rate fluctuation or conditioning it with their own earnings (Frankel 2009).

Data limitation in this paper includes different approaches in data collecting, different data assumptions and definitions, and measurement error. First, considering remittances inflow data, the small size of individual transactions means that they often go undetected by typical data source systems, and the large number of remittance transactions composed by numerous small individual transactions through informal channels pose challenges to data collection. Second,

the limitation of net migration data mainly comes from the volatility of international people mobility. For example, refugee movements may involve large numbers of people moving across boundaries in a short time. Third, another limitation is that life expectancy data is interpolated from 5-year period, so they may not reflect real events as much as observed data.

4 Empirical strategy

4.1 OLS and linear regression approach

Considering ordinary least squares regression (OLS), an OLS estimator is unbiased and consistent when dependent variable doesn't have correlation with error term. Endogeneity leads to the violation of this assumption (Bollen, 2012). From previous literature, Vardanyan (2019), Hansen (2013), and Bloom et al. (2013) show that remittances inflow are associated with unemployment rate in labor market, life expectancy in health economics, and GDP per capita. Thus, adding these factors as control variables to OLS regression generates another linear regression shown in the table below.

OLS regression can be written as:

$$\log(Export_{i,t}) = \alpha(ols)_0 + \alpha(ols)_1 \log(Remittances_{i,t}) + \epsilon(ols)_{i,t}$$

Linear regression with three control variables can be written as:

$$\begin{aligned}\log(Export_{i,t}) &= \alpha_0 + \alpha_1 \log(Remittances_{i,t}) + \alpha_2 \log(Unemployment_{i,t}) \\ &+ \alpha_3 \log(LifeExpectancy_{i,t}) + \alpha_4 \log(GDPperCapita_{i,t}) + \epsilon_{i,t}\end{aligned}$$

Linear regression output table shows that remittances inflow has statistically significant correlation with export in both OLS regression and linear regression with three control variables. The results pass robustness check since the coefficient $\alpha(ols)_1$ and α_1 does not change much. However, the main problem is that the coefficient is positive, which deviates from the theoretical intuition and some literature, where remittances inflow causes negative impact on export. The secondary problem is that adjusted R squared is smaller than 0.5, which means data does not

Table 2: OLS and Linear Regression Output

	(1)	(2)	(3)	(4)
	Export			
Remittances Inflow	0.565***	0.538***	0.482***	0.737***
	(0.0238)	(0.0256)	(0.0350)	(0.0323)
Unemployment		-0.0669	-0.121*	0.216***
		(0.0528)	(0.0582)	(0.0483)
Life Expectancy			2.397***	10.58***
			(0.719)	(1.295)
GDP per Capita				-1.300***
				(0.0991)
Constant	7.315***	8.079***	-0.672	-31.35***
	(0.538)	(0.587)	(2.524)	(4.664)
Observations	907	868	868	861
Adjusted R^2	0.332	0.293	0.307	0.461

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: All the variables of interest are standardized by logarithm. Dependent variable is export and main independent variable is remittances inflow. Columns (1) - (4) report the coefficients with no control variable, with unemployment rate as a control variable, with unemployment rate and life expectancy as two control variables, and with all unemployment rate, life expectancy, and GDP per capita as three control variables respectively.

fit the linear regression model well. In order to eliminate the country-specific effect and year-specific effect, I adopt country ID and year as two fixed effect and discuss the instrumental variable approach below.

4.2 Instrumental Variable approach

In this paper, I employ the similar methodology and instrumental variable applied by Gruber (2020) and Tam (2009). Usage of country ID and year as two fixed effects with panel dataset, allows addressing bias generated by difference in countries and years. On one hand, country ID fixed effect reduces the bias generated by country-specific features. For example, remittance senders' utility also depends on their kinship's utility which affected by traditions and cultures differed from countries, such as kinship taxation where people suffers from sending remittances (Squires, 2016). According to previous literature, Philippines (Bayngos and Jansen 2011), Bangladesh (Chowdhury and Rabbi 2014), Pakistan (Shamim, et al. 2015), and South Asian countries (Jena and Sethi 2020) show negative impact of remittances inflow on export while Kandil and Mirzaie (2008) finds positive relationship in Tunisia. Thus, country fixed effect is crucial. On the other hand, year-specific feature regarding to economy cycle affects remittances inflow. If people are altruistically driven, the inflow of foreign exchange will increase during downturns [5] In addition, the amount of remittances inflow can vary by home countries' economic cycle [6] (Frankel 2009). Moreover, the standard deviation of remittances inflow and export data is significant, which means remittances inflow scattered across countries and years. Therefore, to deal with possible endogeneity problem, I employ panel data, two fixed effects, and adopt emigrants as a novel instrumental variable.

Relevance and exclusion assumptions have to be fulfilled for applying IV (Bollen, 2012). Emigrants as an IV pass the relevance test since the coefficient of first stage is statistically significant, so emigrants has significant correlation with remittances inflow. Moreover, when looking at the first three column, the reduce form shows that the outcome when using emigrants as an IV is statistically significant [7], so remittances inflow can affect export through emigrants.

[5] remittances is countercyclical and has negative correlation with income in migrant's home country.

[6] Remittances are procyclical with respect to income in migrant's host economy

[7] Even though the result is not significant when adding GDP per capita as a control variable in column (4), we can still argue that emigrants as an IV passes reduced form check. GDP per capita is discussed in the last

In table 3, every coefficient in the first stage significantly satisfies the IV relevance assumption when adding controls gradually. From column (4), one percent increase of remittances inflow leads to 2.14 percent decrease of emigrants. Moreover, adjusted R squared is 0.986, so there is a high level of correlation and fitness. In table 4, I check the reduced form and find export is statistically significantly correlated with emigrants except adding GDP per capita in 2015 as a control variable. One percent increase of emigrants significantly leads to 3.23 percent decrease of export without controlling 2015 GDP per capita. In addition, adjusted R squared is 0.937 showing a high level of correlation, so emigrants can be a good IV to satisfy reduced form to a large extent. While the relevance assumption can be tested empirically, the exclusion assumption has to be justified argumentatively, we assume emigrants as an IV is less likely to have significant correlation with error term and follows IV exclusion restriction since emigrants is not likely to have significant correlation with error term. [8]

First Stage:

$$\log(Remittances_{i,t}) = b_0 + b_1 \log(Emigrants_{i,t}) + b_2 \log(Unemployment_{i,t})$$
$$+ b_3 \log(LifeExpectancy_{i,t}) + a_4 \log(2015GDPperCapita_{i,t}) + FE_i + FE_t + \epsilon_{i,t}$$

Reduced Form:

$$\log(Export_{i,t}) = c_0 + c_1 \log(Emigrants_{i,t}) + c_2 \log(Unemployment_{i,t})$$
$$+ c_3 \log(LifeExpectancy_{i,t}) + c_4 \log(2015GDPperCapita_{i,t}) + FE_i + FE_t + \varepsilon_{i,t}$$

The main regression uses log export as an independent variable, log remittances as a dependent variable, and log GDP in 2015 USD as a control variable. GDP per capita is chosen as a control variable because GDP can be a confounder affecting export (Hsiao et al., 2006). This paper does not control other possible confounders which are components of GDP such as investment, consumption, and government revenue to avoid overfitting problem. FE_i is a

paragraph of this section.

[8] The assumption is raised in Introduction and Data sections. I mention it again as a caveat since we can only argue this in words. Employed emigrants is one of the components of emigrated labor force, which is one of the components of total emigrants population. Moreover, there is also a difference between employed emigrants and remittances senders.

Table 3: First Stage

	(1)	(2)	(3)	(4)
	Remittances Inflow			
Linear prediction	-3.909***	-4.883***	-5.137***	-2.139**
	(0.233)	(0.277)	(0.277)	(0.705)
Unemployment		0.324***	0.343***	0.119
		(0.0524)	(0.0517)	(0.0706)
Life Expectancy			3.014***	1.707**
			(0.579)	(0.638)
GDP per Capita				1.155***
				(0.250)
Constant	29.79***	30.88***	18.52***	9.935**
	(0.398)	(0.427)	(2.410)	(3.022)
Observations	948	948	948	948
Adjusted R^2	0.984	0.985	0.985	0.986

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: In table 3, first stage table, all the variables of interest are standardized by logarithm. This table reports the coefficient of the regression in which emigrants has impact on remittances inflow. There are 948 observations since missing data are dropped during the process of logarithm and regression. Adjusted R squared is around 0.985 which shows that data fits the linear regression.

Table 4: Reduced Form

	(1)	(2)	(3)	(4)
	Export			
Linear prediction	-1.748**	-2.946***	-3.229***	-3.795
	(0.537)	(0.708)	(0.727)	(3.148)
Unemployment		0.296**	0.323**	0.366
		(0.114)	(0.116)	(0.261)
Life Expectancy			2.014	2.243
			(1.206)	(1.732)
GDP per capita				-0.205
				(1.112)
Constant	23.32***	24.88***	16.80***	18.38
	(0.929)	(1.105)	(4.961)	(9.885)
Observations	925	925	925	925
Adjusted R^2	0.937	0.937	0.937	0.937

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: In table 4, reduced form table, all the variables of interest are standardized by logarithm. This table reports the coefficient of the regression in which emigrants impacts export by adding control variables gradually from column (1) to (4). There are 925 observations since missing data are dropped during the process of logarithm and regression. Adjusted R squared is 0.937 which shows that data fits the linear regression.

country-specific fixed effect and FE_t is a time specific fixed effect. $e_{i,t}$ is the error term. We are interested in testing whether the impact of remittances on Export, corresponding to the coefficient $alpha_1$ is statistically significant.

Main regression:

$$\log(Export_{i,t}) = a_0 + a_1 \log(Remittances_{i,t}) + a_2 \log(Unemployment_{i,t})$$
$$+ a_3 \log(LifeExpectancy_{i,t}) + a_4 \log(2015GDPperCapita_{i,t}) + FE_i + FE_t + e_{i,t}$$

Then, I compare the coefficient with coefficient in OLS regression and the linear regression without fixed effects in 4.1. From OLS and linear regression output table, remittances inflow has positive causality with export since all the outcome from column (1) to (4) are statistically significant and magnitude varies between 0.482 and 0.737. From IV regression in table 5, export has significant positive correlation with remittances using IV regression from column (1) to (3) and the range of coefficient is from 0.495 to 0.616. For example, in column (3), one percent increase of remittances inflow leads to 0.61 percent increase of export when controlling unemployment and life expectancy. However, in column (4) when controlling GDP per capita in 2015 USD, the standard error increases from 0.14 to 0.34 and the outcome is not significant, even though the coefficient is still positive. The reason of insignificance is that GDP per capita has collinearity with remittances. In addition, Hassan and Shakur (2017) argues U-shaped relationship between remittances and per capita GDP growth in Bangeladesh, and Imai et al. (2014) claims that remittances flow affects economics growth. Even though GDP per capita is not a good control, we still have to control GDP per capita or it will be a confounder affecting both remittances and export.

5 Discussion

5.1 Robustness analysis

I use two approaches to check robustness and find the outcomes pass the robustness check. First, from all tables, the coefficient of main independent variable does not fluctuate much when adding controls from column (1) to column (4), so the above analysis is robust. For

Table 5: IV Regression Output

	(1) Export	(2)	(3)	(4)
Remittances	0.495***	0.616***	0.614***	0.338
	(0.147)	(0.141)	(0.138)	(0.414)
Unemployment		0.110	0.110	0.0992
		(0.0936)	(0.0935)	(0.0930)
Life Expectancy			-0.0547	-0.109
			(1.238)	(1.222)
GDP per Capita				0.563
				(0.824)
Observations	859	859	859	859
Adjusted R^2	-0.111	-0.129	-0.130	-0.097

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

F(1, 757) = 27.32

Notes: In table 5, IV regression output table, all the variables of interest are standardized by logarithm. This table reports the coefficient of the regression in which remittances inflow impacts export using emigrants as an instrumental variable by adding control variables gradually from column (1) to (4). There are 859 observations since missing data are dropped during the process of logarithm and regression. Even though adjusted R squared is around -0.1, F test of excluded instruments shows that F(1, 757) = 27.32 in which IV regression explains the variables of interest well.

example, in table 5, the coefficient is 0.495 in column (1), 0.616 in column (2), and 0.614 in column (3). Even though the magnitude slightly changes and adjusted R squared is small, the F-statistics is 27.32, so the result is significant. Second, I drop the upper-middle income countries and find the IV regression using 47 lower-middle income countries and 27 low countries to test the robustness.

Table 6: IV Regression Output without upper-middle income countries

	(1)	(2)	(3)	(4)
	Export			
Remittances	0.344**	0.456***	0.461***	0.409
	(0.133)	(0.132)	(0.126)	(0.349)
Unemployment		0.191	0.194	0.191
		(0.112)	(0.112)	(0.112)
Life Expectancy			0.217	0.257
			(1.189)	(1.213)
GDP per Capita				0.113
				(0.761)
Observations	496	496	496	496
Adjusted R^2	-0.061	-0.063	-0.066	-0.063

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

F(1, 432) = 18.88

Notes: In table 6, IV regression output table without upper-middle income countries, all the variables of interest are standardized by logarithm. This table reports the coefficient of the regression in which remittances inflow impacts export using emigrants as an instrumental variable by adding control variables gradually from column (1) to (4). There are 496 observations since we only keep lower-middle and low income countries and missing data are dropped during the process of logarithm and regression. Even though adjusted R squared is around -0.06, F test of excluded instruments shows that F(1, 432) = 18.88 in which IV regression explains the variables of interest well.

In table 6, the magnitude of coefficient does not change much and the correlation is significantly positive in column (1), (2), and (3). Thus, the results passes robustness check. In addition, another reason to drop upper-middle income countries is that selection bias partly comes from the upper middle-income countries since some countries like Mexico, Sweden, and Brazil have high GDP per capita and large amount of export with extreme values compared to low-income countries. For example, Mexico's GDP per capita in 2015 USD is 1.05E+12 in 2010 and 1.18E+12 in 2011, however, other countries's magnitude is E+10 or even smaller. By implementing the second robustness check in which dropping the upper-middle income coun-

tries, I partly eliminate the selection bias and receive the similar magnitude and significance. This proves that the previous analysis is valid by using 118 countries varied from upper-middle to low income countries.

5.2 Discussion

Recall the economic intuition and mechanism, on one hand, higher remittances inflow leads to higher money supply in home country and inflation which reduces the competitiveness of export. On the other hand, the higher money supply leads to depreciation of home currency which leads to the increase of export. The two opposite effects on export brings difficulty on the impact of remittances inflow on export. A possible reason for the inconsistency of economic intuition and reality is that this paper assumes exchange rate is an exogenous variable which has no effect on omitted variable bias.

From previous literature, the impact of remittances inflow on either export or exchange rate is ambiguous for specific countries. From the data in World Bank used in this paper, the impact of exchange rate on export is insignificant. There are two main reasons of the inconsistency between specific country in the previous literature and the overall relationship in this paper. First, different currencies have different ability to resist the fluctuation of money supply. For a specific country, if the impact on export caused by real exchange rate is larger than the impact on export caused by inflation, higher remittances inflow will more likely lead to higher export. If the impact on export caused by real exchange rate is smaller than the impact on export caused by inflation, higher remittances inflow will more likely lead to lower export. Moreover, there are other mechanism to explain the relationship among remittances, money supply, exchange rate, and export such as price-specie-flow [9] or theories about foreign direct investment which is not discussed in this paper. [10]

Second, the overall relationship only matters from the perspective of international organizations at global level, but not individual countries. Even though this paper finds that higher remittances inflow causes higher export for all developing countries overall, the result has lim-

[9]Price-specie-flow argues that current account deficits cause gold outflows which reduces money supply. Fall in money supply causes a gradual fall in domestic prices. Falling domestic prices raise export competitiveness which improves the current account and induces a gold inflow.

[10]Calvet (1981) discusses the theory of the multinational firm and multinational phenomenon as result of an international differentiation of activities among nations.

ited practical reference for a national government to make policies, given that trade policies and financial policies vary among countries. Luckily, The positive causality of remittances inflow and export might provide information to the global organizations such as World Bank and United Nations to do further researches.

5.3 Endogeneity concerns and improvements

There are omitted variables correlated with export and remittances including export elasticity, trade openness, and industrial capacity (Beja and Edsel, 2011). Other possible endogeneity problems including measurement error coming from the inaccuracy of the initial dataset discussed in the data limitation section. Regarding export elasticity, Vardanyan (2019) proposes a realistic assumption that elasticities of export of goods with respect to real exchange rate fluctuations are uneven, so some types of products are relatively immune to an appreciation shock while others are not. If main exported goods of developing countries are elastic, their price might not be affected by the economic intuition. Instead, export might be affected by terms of trade policies and other sociopolitical factors. Further researches can use export data weighted by price elasticity. Regarding trade openness, further research can add a dummy variable to illustrate a specific policy available or not for each country. Moreover, further research can measure trade openness using trade to GDP ratio according to Bleanay and Tian(2022) or from the gravity model [11] according to Fujii (2019). Regarding industrial capacity, further research can classify exported goods by industries and add industry ID as the third fixed effect. This can cross out the heterogeneity generated by different characteristics of different industries.

Improvements and possible models for further researches [12]

[11] The basic model for trade between two countries (i and j) takes the form of $F_{i,j} = GM_iM_j/D_{i,j}$, where G is a constant, F is trade flow, D is distance and M is the economic dimensions of the countries.

[12] y is log export and x is log remittances inflow.

1. Add a dummy variable:

$$y_{i,t} = a_0 + a_1 x_{i,t} + a_n Controls + FE_i + FE_t + Dummy_{i,t} + error_{i,t}$$

2. Consider gravity model: $F_{i,j} = GM_i M_j / D_{i,j}$

3. Consider industry-specific fixed effect:

$$y_{i,t,k} = a_0 + a_1 x_{i,t,k} + a_n Controls + FE_i + FE_t + FE_k + error_{i,t,k}$$

6 Conclusion

Using dataset of 118 developing countries grouped by upper-middle income and lower-middle and low income countries from 2010 to 2019, I examine the possible impact of remittances inflow on export. The novel instrumental variable, emigrants, passes the IV relevance assumption and exclusion assumption. This paper finds that increasing amount of remittances inflow causes export increases. When dropping upper-middle income countries, the significant positive correlation still exists, and magnitude of coefficient doesn't change much. This paper also finds that controlling GDP per capita leads to insignificance since GDP per capita has collinearity with remittances inflow. Also, the other endogeneity problems including export elasticity, diversification and concentration will make the empirical result deviate from theoretical intuition. Further research needed to address questions originated from finding better control variables and adopting advanced models.

Appendix

118 countries used in the research (66 lower-income and low income countries shown in bold)

Afghanistan	Cabo Verde	Gabon	**Lao PDR**	**Northern Mariana Islands**	St. Martin (French part)
Albania	Cambodia	**Gambia**	**Lebanon**	**Norway**	**Sudan**
Algeria	**Cameroon**	Georgia	Liberia	**Palau**	**Sweden**
American Samoa	**Central African Republic**	**Ghana**	Libya	Panama	Tajikistan
Angola	Colombia	Grenada	**Liechtenstein**	**Paraguay**	**Tanzania**
Argentina	**Comoros**	Guatemala	Madagascar	**Peru**	Thailand
Armenia	**Congo, Dem. Rep.**	**Guinea**	Malawi	Philippines	Togo
Azerbaijan	**Congo, Rep.**	**Guinea-Bissau**	Malta	Portugal	**Trinidad and Tobago**
Bangladesh	Costa Rica	**Guyana**	Mauritania	**Puerto Rico**	**Tunisia**
Belarus	**Cote d'Ivoire**	**Haiti**	Mauritius	Romania	**Turkiye**
Belize	Cuba	**Honduras**	Mexico	Samoa	**Turks and Caicos Islands**
Benin	**Djibouti**	**India**	Micronesia, Fed. Sts.	San Marino	**Tuvalu**
Bhutan	Dominica	**Indonesia**	**Moldova**	Sao Tome and Principe	**Uganda**
Bolivia	Dominican Republic	Iran, Islamic Rep.	Monaco	**Saudi Arabia**	**Uzbekistan**
Bosnia and Herzegovina	Ecuador	**Ireland**	**Montenegro**	**Seychelles**	**Vietnam**
Botswana	**Egypt, Arab Rep.**	Jamaica	**Mozambique**	**Sierra Leone**	**Virgin Islands (U.S.)**
Brazil	Equatorial Guinea	**Kazakhstan**	**New Caledonia**	**Singapore**	**Yemen, Rep.**
Bulgaria	**Eritrea**	**Kenya**	**Niger**	**Solomon Islands**	**Zambia**
Burkina Faso	**Ethiopia**	Kosovo	**Nigeria**	Somalia	
Burundi	Fiji	**Kyrgyz Republic**	North Macedonia	South Africa	

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