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Could the COVID-19 Crisis Affect Remittances and Labour Supply in ASEAN Economies? Macroeconomic Conjectures Based on the SARS Epidemic

Alberto POSSO[#§]

Centre for International Development, RMIT University, Australia

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Abstract: *Debates on resilience to economic shocks in the ASEAN region focus on what policymakers can do to mitigate negative impacts associated with financial-economic crises. The COVID-19 pandemic has made it clear that the region is also vulnerable to health-economic crises. This study applies a difference-in-difference strategy to data from the 2003 SARS epidemic to shed light on how a global pandemic can affect labour supply and remittances in ASEAN economies. Findings suggest that even a relatively short-lived epidemic can have long-lasting effects on labour supply.*

Keywords: SARS; ASEAN; Labour supply; Remittances.

JEL Classification: O11; J21; F24.

[#] Correspondence: Centre for International Development, RMIT University., 445 Swanston Street, Melbourne, VIC, 3004, Australia. Phone: 61 39 9925 5669. E-mail: alberto.posso@rmit.edu.au.

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1. Introduction

Debates on resilience to economic shocks in the Association of Southeast Asian Nations (ASEAN) region have mostly focused on what policymakers can do to mitigate the negative impacts associated with financial-economic crises, such as the Asian and global financial crises (Hui and Kiesha, 2016; Case, 2009). The current COVID-19 pandemic has shown that economies around the world, including those in ASEAN, are vulnerable to health-economic crises. Policymakers are unprepared to deal with the complications associated with these crises due to the paucity of research on the vulnerability of ASEAN economies to crises.

Although both financial and health crises have significant effects on the real economy, they also impact various other parts of the economy and therefore require different policy responses. For example, financial crises affect access to credit, which generally curtails investment and can result in broad and prolonged crises that reflect issues in the structure of the economy (Walter, 2013). Health crises can have effects on more vulnerable segments of the population (i.e. those who cannot socially distance or work from home) (Brodeur, Gray, Islam, and Bhuiyan, 2020). Furthermore, while a financial crisis affects the labour market through a credit crunch, a health crisis can directly affect the labour market by stopping individuals from working – either because of illness or social-distancing measures.

The mechanism leading to international contagion in financial crises stems from disruptions to the international credit market. The COVID-19 pandemic has shown that shocks to labour markets in one country can potentially affect economic outcomes and labour markets in another – that is, the contagion mechanism works through labour market disruptions. This study therefore focuses on worker remittances to highlight this potential channel. Prior to the pandemic, migrant remittances had become a major source of external financing for many developing nations, including those in ASEAN (Ratha, 2019). As lockdowns have spread across the world, however, migrant sectors have been disproportionately negatively impacted, resulting in a significant decline in remittances to developing countries (Sayeh and Chami, 2020).

This study examines the effect of a pandemic on the labour market, with a focus on domestic labour supply and international remittances to capture both local and international economic mechanisms through which a pandemic can affect household well-being. Due to data availability, the study highlights the severe acute respiratory syndrome (SARS) epidemic, which predominantly affected Asia in 2003. This study focuses on the ASEAN region because it constitutes a group of integrated economies, with some directly affected by the epidemic through active cases and others serving as a control group.

Remittances and labour supply are also of interest given the potentially interrelated relationship in developing economies. While remittances are understood to lead to improvements in health, education, inequality, and poverty (World Bank 2006; Giuliano and Ruiz-Arranz, 2009; Acosta, Calderon, Fajnzylber, and Lopez, 2007), their effect on the labour supply is ambiguous. Lower remittances can decrease reservation wages, which increases labour supply; yet, fewer remittances can lower investment opportunities, leading to lower labour supply.

This topic has received some attention in the extant literature using both household- and country-level data. Microeconomic studies found that remittances tend to lower labour supply, while one macroeconomic study reached the opposite conclusion (Posso, 2012). This discrepancy may be due to the fact that significant increments in income at the community or aggregate level generated by remittance inflows create new employment opportunities for non-recipient households. That is, remittances can potentially exert a multiplier effect on employment that is not evident at the household level but becomes evident when using aggregate-level data.

The remainder of this paper is structured as follows. The first empirical section focuses on the relationship between remittances and labour supply using macroeconomic data. The second section adopts a difference-in-difference (DiD) methodology to test if the SARS epidemic had a causal impact on the labour supply and remittances in the ASEAN region.

2. SARS Epidemic and Economic Outcomes

Much like COVID-19 (also known as SARS-CoV-2), its predecessor, SARS (CoV-1), swiftly spread across the globe after first appearing in China. In the 6 months after the first outbreak in late 2002 in Guangdong, SARS spread to around 28 countries, as far away as Brazil, Canada, South Africa, Spain, and the United States (Lee and McKibbin, 2004a).

Most of the literature on the economic effects of epidemics and pandemics have focused on disease-associated medical costs or forgone incomes resulting from disease-related morbidity and mortality (Lee and McKibbin, 2004b). Other studies have focused on assessing the damages caused by SARS to key industries, such as tourism and retail (e.g. Chou, Kuo, and Peng, 2004; Hai, Zhao, Wang, and Hou, 2004; Siu and Wong, 2004). Micro-level (i.e. industry) studies cannot provide a full picture of the impact of SARS, because they ignore interlinkages within economies across sectors.

Broader economic studies have been more descriptive, observing trends in macroeconomic data to make inferences about the effect of SARS (e.g. Fan 2003, Hanna and Huang 2004). Lee and McKibbin (2004b) appears to be the only study that applied rigorous analytical techniques to study the economic effects of SARS. Using a computable general equilibrium model, cross-country data, and econometric techniques, they found that SARS had a significant impact on China and Hong Kong. They noted that the impact was not a direct consequence of the disease, however, but rather the effect of the disease on consumer behaviour. They argued that the true cost of disease is far greater than cost to a health budget. They warned that

> [i]f the threat of recurring SARS or SARS-like diseases from China is real, then the estimated risk to economic activity in the region and the world, as calculated in this paper, could be very large. The estimates of our model suggest that there is a strong economic case for direct intervention in improving public health in China and other developing countries in which there is inadequate expenditure on public health and insufficient investment in research on disease prevention to avoid the future outbreak of a major pandemic (p.130).

Unlike Lee and McKibbin (2004b), in this study, panel data econometric techniques aimed at estimating causal effects are applied. SARS is the focus to make inferences about the effects of the COVID-19 pandemic because of key similarities between the two outbreaks. Importantly, one distinction is that unlike COVID-19, medical sectors in affected countries were not overwhelmed during the SARS outbreak. Indeed, incidence of SARS in the population was small and contained to hospital outbreaks, while hospitalisation of SARS patients was short, with more than 90% recovering to full health in a short period (Lee and McKibbin, 2004a). Therefore, unlike COVID-19, the SARS-related demographic or human capital consequences were small. At the end of the outbreak, the cumulative number of SARS cases stood at 8,437 with 813 deaths. In contrast, by the end of January 2021, there were 100 million confirmed cases of COVID-19, with approximately 2.5 million deaths (WHO 2015, Petersen et al. 2020).

Although the SARS-associated medical expenditures and demographic consequences are understood to be small, Lee and McKibbin (2004b) identified that SARS, like COVID-19, caused substantial economic effects through at least two other important channels. First, as with COVID-19, fear of SARS infection led to a substantial decline in consumer demand, especially for travel and retail sales services, as people practiced social distancing. Indeed, as with COVID-19, a key public health policy response to suppress the SARS virus in 2003 was quarantining (Hanna and Huang, 2004).

In addition, SARS affected an interconnected world. Lee and McKibbin (2004b) argued that trade was an important channel through which SARS impacted economies, particularly by damaging confidence. Indeed, this study focuses on the potential effect of remittances because they reflect globalisation channels, are potentially used by households in response to adverse domestic shocks, and are understood to have been significantly impacted during the COVID-19 pandemic.

3. The COVID-19 Pandemic and Labour Market Outcomes

Although the effects of the COVID-19 pandemic are far from over, it has already attracted a significant amount of economic research. Some of this research touches on labour market outcomes, as labour-related issues are key to understanding the impact of COVID-19 on the economy.

There are three main channels through which the pandemic is affecting the economy. First, consumption of goods and services has fallen due to social-distancing measures. Second, as consumption falls, savings increase, and consumption decreases further, which affects financial markets. Third, lockdowns and shutdowns are negatively affecting labour markets, leading to rising unemployment (Carlsson-Szlezak, Reeves, and Swartz, 2020; Brodeur, Gray, Islam, and Bhuiyan, 2020).

A large amount of literature exists on the effect of COVID-19 on hours of work and unemployment (Brodeur, Gray, Islam, and Bhuiyan, 2020). Studies from the United States have exploited, within state variations, social distancing responses to measure the relationship between policies and unemployment. For example, Gupta et al. (2020) found that the employment rate fell by approximately 2 percentage points for every 10 days that a state experienced a stay-at-home mandate. Another strand of studies, focusing on job type, showed that workers who could work from home are less likely to lose their jobs (i.e. Adams-Prassl, Boneva, Golin, and Rauh (2020) for the United States and the United Kingdom; Béland, Brodeur, Haddad, and Mikola (2020) for the United States).

As disproportionate effects of COVID-19 on the working class are being well documented, only two studies have focused on immigrants. Borjas and Cassidy (2020) showed that the COVID-19 shock led to a fall in employment rates of immigrant men compared to native-born men in the United States. Yasenov (2020) posited that workers with lower levels of education, younger adults, and immigrants are concentrated in occupations that are less likely to be performed from home; therefore, they are more likely to be affected by the COVID-19 crisis.

Most available studies focus on the United States and other developed economies. However, the effects of shutdowns and lockdowns on labour markets in developing countries are not necessarily the same as those observed in developed

economies. A primary reason for this is that many poor in the developing world work in informal sectors, lacking access to credit, savings, and formal insurance channels. Therefore, individuals in developing countries may be more likely to work more to make ends meet. With many schools closed throughout the developing world, the negative household-level income shock is also likely to push some children into labour and out of their homes.

The International Labour Organization (ILO) (2020) examined the impact of COVID-19 on employment and the labour market in the Philippines. Macroeconomic data highlighted how lockdowns and shutdowns have reduced the demand for labour, leading to an oversupply of available labour. As such, by April 2020, the Philippines had recorded its most severe unemployment rate on record – 17.7%, up from around 5.0% in January 2020. Labour force participation fell from 61% in April 2019 to 56% 1 year later. Informal workers in the arts, hospitality, and entertainment sectors were disproportionately hit; although ILO did not document people leaving informal employment to enter formal work, this may be an important by-product of this shock.

A fall in remittances may also exacerbate this effect. According to ILO (2020), more than 173,000 Filipino workers have repatriated since the pandemic began. Coupled with the fact that migrants are more likely to be employed in jobs where working from home is difficult, it is likely that remittances have significantly fallen. Indeed, the World Bank (2020) projected that remittance inflows to East Asia and the Pacific fell by 11% in 2020.

Murakami, Shimizutani, and Yamada (2020) agreed, calculating the potential impacts of the COVID-19 pandemic on the welfare of remittance-dependent households in the Philippines. Using data collected in 2016 and 2017, they showed a positive relationship between remittances and expenditure/income measures.[1] Then, using 2020 gross domestic product (GDP) projections from around the world, they estimated that remittance inflows will decrease by 14%–20% – and that

[1] Defined as (i) average monthly household expenditure per capita, (ii) average monthly household food expenditure per capita, (iii) average monthly household non-food expenditure, (iv) average monthly new savings deposits per capita, (v) average monthly loan repayment per capita, (vi) agricultural income, (vii) non-agricultural income, and (viii) average monthly household income from domestic sources.

household spending per capita will decline by 1%–2% – in 1 year as a result of the pandemic.

4. Remittances and Labour Supply

This study contributes to the literature that focuses on whether remittances lower labour supply in recipient economies. Most studies have addressed this issue by looking at household-level data, particularly in Asia and Latin America. From the microeconomic literature, remittances tend to lower the labour supply, particularly for women. For example, Funkhouser (1992) used data from Nicaragua to show that remittances increase male self-employment while reducing the female labour supply. Similarly, Acosta (2006) demonstrated that remittances are negatively related to the female labour supply, although adult male labour force participation is unaffected. Rodriguez and Tiongson (2001) used data from the Philippines to show that men and women have lowered the amount of time that they choose to spend working after receiving remittances. Kim (2007) reached similar conclusions using Jamaican data. Similarly, Amuedo-Dorantes and Pozo (2006) found no evidence of a reduced labour effort resulting from greater remittance incomes amongst Mexican men. Instead, they noted that remittances only seem to alter the allocation of the male labour supply across various types of employment.

Women appear to work less in response to receipt of greater remittances, although this was found exclusively in the informal sector and non-paid work in rural areas. In Amuedo-Dorantes and Pozo (2012), a panel of Mexican households was used to find that male and female labour supply decrease with higher levels of remittance income. Similarly, Airola (2008) found that remittances are associated with fewer work hours for households in general. Hanson (2007) noted that over the 1990s, women – not men – in high-migration Mexican states became less likely to work outside of the home than women in low-migration states after an inflow of remittances. Cuadros-Menaca and Gaduh (2020) also posited that remittances decrease female labour supply using Colombian data.

A small number of studies found an insignificant relationship, however. Cox-Edwards and Rodriguez-Oreggia (2009) found little evidence of the labour force effects of remittances in Mexico. Using data from Haiti, Jadotte (2009) found that remittances are associated with a statistically insignificant relationship. Vadean, Randazzo, and Piracha (2019) found that remittances received by households in Tajikistan decrease male wage employment but increase self-employment, without affecting the number of job-specific hours worked.

Posso (2012) used aggregate-level data to examine movements in the labour supply, arguing that changes in household behaviour do not necessarily translate to significant changes in the aggregate labour supply, which is more relevant in understanding overall changes in unemployment, GDP, and real wages in an economy. Unlike the micro-level literature, he found a positive and significant relationship between remittances and the aggregate labour supply. One reason for this discrepancy may be that remittances exert a multiplier effect on employment that is not evident at the household level but becomes evident when using aggregate-level data.

5. Data

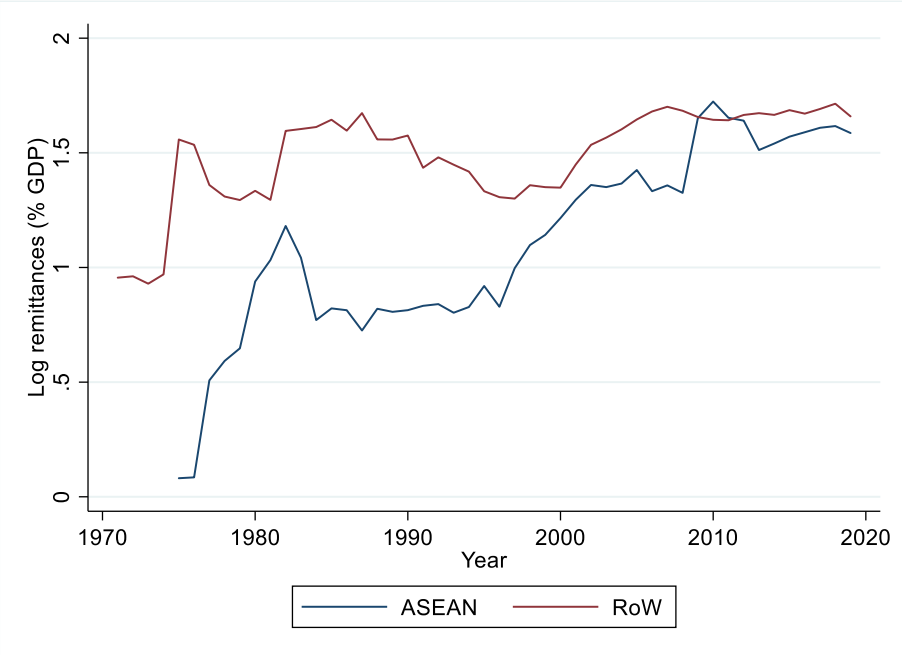
5.1 Macroeconomic Data

For this study, macroeconomic data are derived from World Bank (2021), which provide information on personal remittances measured as a share of GDP and expressed in percentage terms. Remittances are defined as the sum of personal transfers and compensation of employees. They include all current transfers in cash or in kind made or received by resident households to or from non-resident households. Personal transfers include all current transfers between resident and non-resident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by non-resident entities. Data in log form are used for two reasons: (i) they allow interpretations of some coefficient estimates as elasticities, and (ii) logged data more closely adhere to parallel trends requirements for the DiD analysis.

Figure 1 depicts the log of remittances as a share of GDP in ASEAN versus the rest of the world. The figure shows that while remittances started from a lower base in ASEAN economies, they have a higher rate of growth than those in the rest of the world.

Figure 1: Log of Remittances as a Share of Gross Domestic Product in ASEAN and Rest of the World, 1970–2019

(%)



ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product, RoW = rest of world.
Source: World Bank (2021).

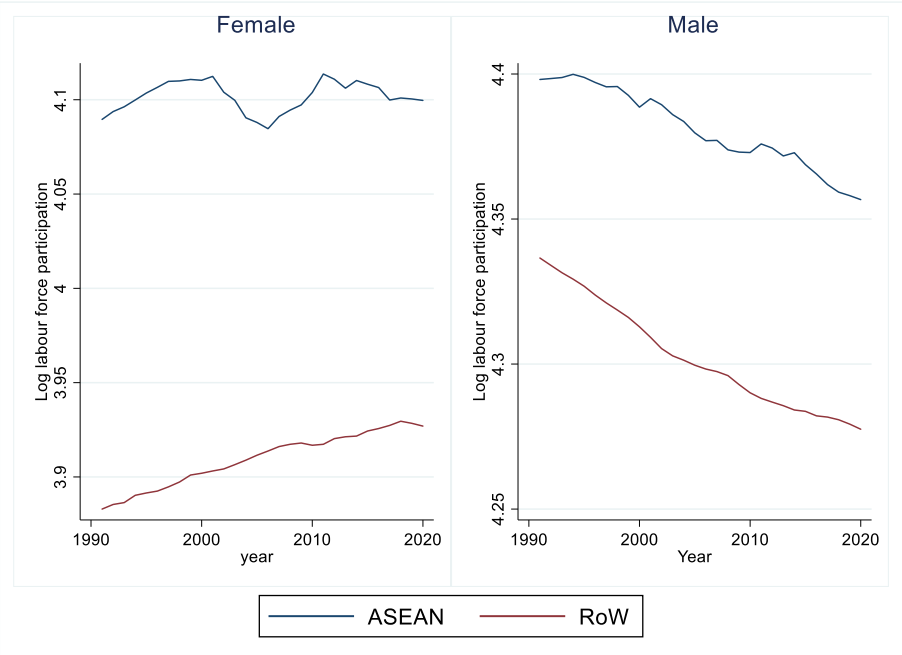
The use of macroeconomic remittance data presents an important limitation to this study. The series is potentially measured with errors, which are likely to have become more accurate through time (Maimbo and Ratha, 2005; Posso, 2012). Remittance inflows through informal channels are potentially very large, although the rise of credit unions and other financial institutions has reduced this to an extent (Posso, 2012). Additionally, the collection of remittance data during the 1980s was very poor but has increased in quality through time. Potentially, therefore, the large increment in remittances discussed in the literature and in this study may reflect better measurement of receiving governments and a larger portion of transfers

going through the formal system. Year fixed effects and country-specific time trends are included to account for some of these data problems.

The labour force participation rate is the proportion of the population age 15 years and older that is economically active. Figure 2 shows that labour force participation is higher in ASEAN economies. The left-hand panel, female labour force participation, shows a constant trend throughout the period for ASEAN economies and an upward trend for the rest of the world. The right-hand panel, male participation, shows declines in both ASEAN economies and the rest of the world.

Figure 2: Log of Labour Force Participation in ASEAN and the Rest of World, 1990–2020

(% of population)



Note: The labour force represents those age 15 years and older.
ASEAN = Association of Southeast Asian Nations, RoW = rest of world.
Source: World Bank (2021).

In the econometric analysis, economic development is included as important confounder of the labour supply–remittances relationship. GDP per capita measured in 2010 US dollars is included and logged for consistency.

5.2 Data on the SARS Epidemic

For this study, macroeconomic data are coupled with SARS data available from the World Health Organization (2015). The analysis adopts a two-tiered approach, comparing countries affected by each outbreak in each period using (i) a dummy variable, and (ii) the actual number of recorded cases and deaths. The first approach employs a dummy variable that is equal to 1 for country *j* affected by SARS at time *t*. In subsequent regressions, the dummy variable is substituted with a variable that records the actual number of deaths or cases per country in each year. All recorded cases occurred from November 2002 to July 2003. In the analysis, 2003 is treated as the year of the outbreak.

It is important to note that while using dummies gives equal weight to the burden of disease across affected countries at a given point in time, using case numbers underestimates the burden of disease due to problems surrounding reporting systems, testing, and disease identification (Hanna and Huang, 2004). Table 1 summarises the data used in the study.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Macroeconomic data					
Log remittances	231	1.07	0.77	0.02	2.81
Log female labour force participation	231	4.08	0.21	3.76	4.41
Log male labour force participation	**231**	4.38	0.05	4.24	4.50
Log GDP per capita	**231**	1.12	0.59	0.28	2.60
SARS data					
Treated (affected country dummy)	231	0.61	0.49	0	1
Total cases	231	0.40	4.29	0	63
Deaths	231	0.05	0.40	0	5

GDP = gross domestic product, SARS = severe acute respiratory syndrome.
Sources: World Bank (2021), WHO (2015).

6. Empirical Specifications

6.1 Remittances and Labour Supply

The study first estimates a baseline empirical model to capture the relationship between remittances and labour supply in ASEAN. The appendix shows the results of models that capture the relationship between remittances and the labour supply using a large sample of 130 developing countries.

Linear regression is then used to absorb country-specific characteristics with country fixed effects, which control for time-invariant factors that can confound the relationship between remittances and labour supply. A model is also estimated that corrects for the degrees of freedom used to estimate fixed effects, which are relatively more robust.[2] Year fixed effects are also included, which control for covariate shocks that can potentially confound the relationship. The regression thus takes the following form:

$$LF_{i,t} = \beta_1 R_{i,t} + \beta_2 Y_{i,t} + \alpha_i + \lambda_t + \varepsilon_{i,t}\,, \qquad (1)$$

where $LF_{i,t}$ refers to the labour force participation of males and females, respectively, for country i at time t. $R_{i,t}$ is remittances as a share of GDP, while $Y_{i,t}$ is GDP per capita, which proxies for average national income and is deemed an important confounder in the remittances–labour supply relationship. As highlighted above, all these terms are logged so that coefficient estimates are interpreted as elasticities. The term α_i is a country fixed effect, λ_t is a year fixed effect, and $\varepsilon_{i,t}$ is a normally distributed mean-zero error term.

In another specification, country-specific time trends are also included to account for various government policies or internal shocks that can potentially impact labour supply within countries. Accounting for national-level policies is important given that it is possible that the labour supply changes due to labour market policies, rates of urbanisation, or internal shocks. Both year fixed effects and country-specific time trends also control for improvements in the measurement

[2] The *areg* command, instead of *xtreg*, is used in STATA.

of remittances as well as policy changes that may lead to changes in remittances. Including these changes, Equation (1) becomes:

$$LF_{i,t} = \beta_1 R_{i,t} + \beta_2 Y_{i,t} + \alpha_i + \lambda_t + t \cdot \alpha_i + \varepsilon_{i,t}, \quad (2)$$

where $t \cdot \alpha_i$ is a country-specific time trend.

6.2 Labour Supply, Remittances, and the SARS Epidemic

To test how the SARS epidemic affected labour supply and remittances, a two-tiered approach is adopted to understand if pandemics have a statistically significant relationship with remittances and the labour supply. Within ASEAN, the SARS epidemic behaves as a natural experiment. First, since SARS did not exist prior to 2003, a clear treatment date is available. Second, not all ASEAN countries had SARS cases – only Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam – so a clear control group can be sourced from the remaining economies. As a result, a DiD approach can be adopted to estimate the role of pandemic remittances and the labour supply:

$$Y_i = \gamma_c + \lambda_t + \beta D_{cs} + \varepsilon_i, \quad (3)$$

where *c* denotes a country and *t* denotes the time period. The term γ_c is a dummy equal to 1 for countries that experienced SARS, while the term λ_t is a period dummy equal to 1 when treatment began. The term D_{cs} is the DiD, which is estimated as the product of γ_c and λ_t. Thus, β is defined as the DiD estimator. As above, ε_i is an error term. Time fixed effects and country-specific time trends are added in robustness exercises. Finally, as mentioned above, in other specifications, the term γ_c is substituted with the number of cases or deaths. In this case, the term D_{cs} is also redefined to focus on the difference in the number of cases/deaths between the treated and control groups at a given point in time.

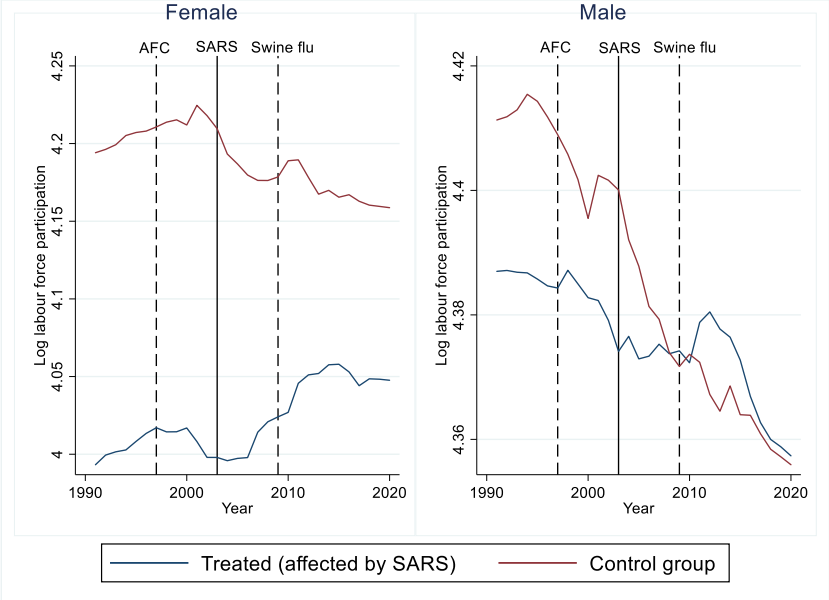
The robustness of the DiD estimator is tested by making the results interchangeably conditional to (i) GDP per capita, (ii) country fixed effects, (ii) year fixed effects, and (iv) country-specific time trends. The inclusion of country fixed effects naturally replaces γ_c with country-specific dummies in Equation (3).

In DiD, the study assumes the onset of a treatment or event. This is modelled by setting a dummy variable equal to 1 from when treatment began and every period thereafter, and 0 otherwise. The SARS epidemic abruptly ended in 2003 with few cases appearing thereafter. As such, treatment technically ended after 1 year of exposure. From an economic perspective, the economic and psychological consequences of that epidemic cannot be assumed to have ended with the disease. Thus, in subsequent work, an agnostic approach is adopted by creating treatment that lasted for 1–17 years over 2003 to 2019.

The assumptions underlying DiD estimators are based on a counter-fact – countries that do not experience a given outbreak during a given time period allow the researcher to make inferences as to what labour supply and remittances would look like in a given country in the absence of a pandemic. The estimator focuses on the average difference over time in the outcome variables for the treatment group (i.e. countries experiencing a pandemic) compared to the average difference over time for the control group (i.e. those that are not), hence the DiD. The key identifying assumption of the DiD estimator is that labour supply or remittances trends would have been the same in both treated and untreated countries in the absence of the pandemic (or treatment). Trends in labour supply and remittances would have the same slope across countries prior to the pandemic.

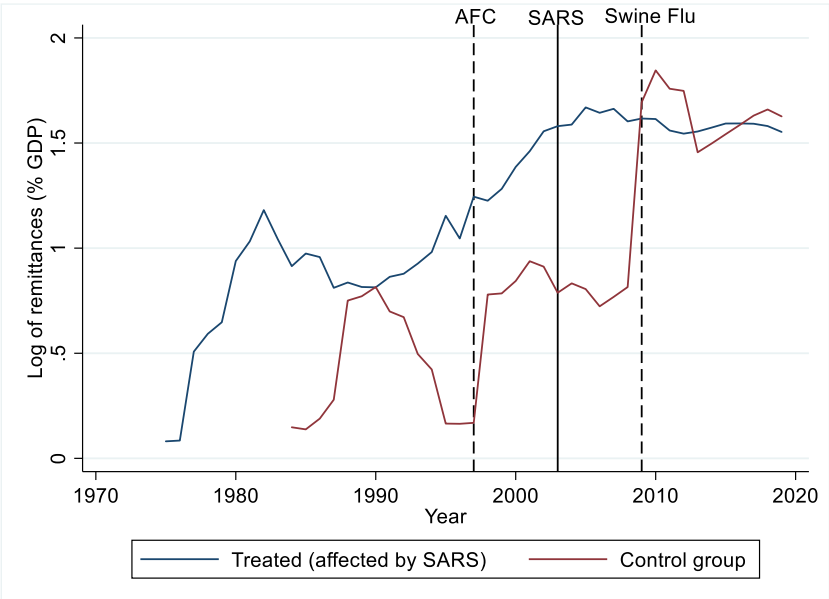
This assumption is tested in Figures 3 and 4 using the logs of labour force participation rates and remittances, respectively. The figures depict other shocks expected to influence both labour supply and remittances: the Asian financial crisis and the swine flu epidemic, which began in January 2009 and coincided with the global financial crisis. Both the Asian financial crisis and the global financial crisis are considered covariate shocks that should be absorbed by year fixed effects and do not pose any risk to the identification strategy.

Figure 3: Trends in Labour Force Participation Rates (logs) in ASEAN, 1990–2019



AFC = 1997 Asian financial crisis, SARS = severe acute respiratory syndrome.
Source: Author's calculations based on World Bank (2021) and WHO (2015).

Figure 4: Trends in Remittances as a Share of Gross Domestic Product (logs) in ASEAN, 1970–2019



AFC = 1997 Asian financial crisis, SARS = severe acute respiratory syndrome.
Source: Author's calculations based on World Bank (2021) and WHO (2015).

The left- and right-hand panels in Figure 3 show parallel trends between the treated and control groups prior to SARS with a marked deviation thereafter. However, in Figure 4, very different trends emerge before the Asian financial crisis, although a parallel trend is evident after the Asian financial crisis and before the SARS epidemic. Moreover, after 2003, there is a significant difference in trends continuing until the onset of the global financial crisis and the swine flu.

7. Results

7.1.1 Remittances and Labour Supply in ASEAN Countries

Table 2 presents the fixed effects results, highlighting the relationship between remittances and the labour supply. The results in columns 1 and 2 show a negative relationship between remittances and the female labour supply. While the results in column 1 are statistically insignificant, those in column 2, which include country-specific time trends, are significant at the 5% level. Columns 2 and 4 are preferred specifications, because they control for within-country time-variant factors that may confound the relationship between remittances and the labour supply and are, therefore, less subject to omitted variable bias. Overall, the results in column 2 suggest that an increase in remittances by 10% is associated with a decrease in the female labour supply by 0.1%.

It also shows that there is no statistically significant relationship between remittances and the aggregate male labour supply. Although small, the relationship found for women is consistent with some micro-level empirical evidence that suggests that remittances can be used to substitute for female employment and into unpaid domestic labour (Acosta, 2006; Hanson, 2007; Cuadros-Menaca and Gaduh, 2020). Overall, the table suggests that remittances are unlikely to lead to large aggregate changes in the labour supply.

Table 2: Remittances and Labour Supply in ASEAN, Fixed Effects Results

	(1)	(2)	(3)	(4)
Dep variable: labour force participation of:	**Female**	**Female**	**Male**	**Male**
Log remittances	–0.023	–0.011**	0.0041	–0.0063
	[–1.44]	[–2.39]	[0.37]	[–1.10]
Log GDP per capita	–0.16	–0.073	–0.13	–0.019
	[–0.93]	[–0.46]	[–1.58]	[–0.34]
Country and year fixed effects	Yes	Yes	Yes	Yes
Country-specific time trends	Yes	No	Yes	No
Observations	231	231	231	231
R-squared	0.97	0.99	0.89	0.97

ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product.
Notes: Robust t-statistics clustered at the country level in brackets. ** denotes statistical significance at the 5% level.
Source: Author's calculations based on World Bank (2021).

7.1.2 Labour Supply and SARS in ASEAN countries

Table 3 presents the DiD results describing the relationship between SARS and the labour supply. Overall, the DiD estimator shows that countries that experienced SARS were not more or less likely to experience a change in labour supply.

Table 3: Labour Supply and SARS in ASEAN, Difference-in-Difference Results

	(1)	(2)	(3)	(4)	(5)
Panel A: Female labour force participation					
DiD estimator	0.064	0.061	0.054	0.068	–0.013
	[1.53]	[1.38]	[1.14]	[1.62]	[–0.58]
Log GDP per capita	–0.059*	–0.060	–0.029	–0.16	0.047
	[–1.83]	[–1.77]	[–0.26]	[–1.17]	[0.36]
Year fixed effects	No	Yes	No	Yes	Yes
Country fixed effects	No	No	Yes	Yes	Yes
Country-specific time trend	No	No	No	No	Yes
Observations	317	317	317	317	317
R-squared	0.31	0.32	0.93	0.94	0.98
Panel B: Male labour force participation					
DiD estimator	0.034	0.034	0.018	0.0086	0.0014
	[1.22]	[1.17]	[0.83]	[0.38]	[0.087]
Log GDP per capita	–0.014*	–0.013*	0.0020	0.085*	–0.0020
	[–2.14]	[–1.98]	[0.058]	[1.88]	[–0.053]
Year fixed effects	No	Yes	No	Yes	Yes
Country fixed effects	No	No	Yes	Yes	Yes
Country-specific time trend	No	No	No	No	Yes
Observations	317	317	317	317	317
R-squared	0.20	0.22	0.80	0.85	0.94

ASEAN = Association of Southeast Asian Nations, DiD = difference-in-difference, GDP = gross domestic product, SARS = severe acute respiratory syndrome.
Note: Robust t-statistics clustered at the country level in brackets.
Source: Author's calculations based on World Bank (2021).

In Table 4, whether this result holds is tested, using both cases of SARS and deaths. The results remain unchanged.

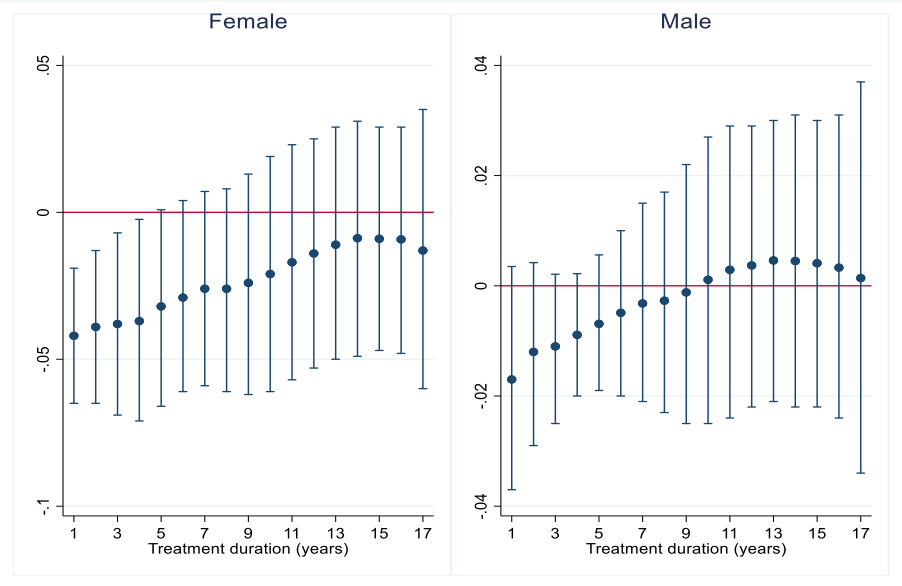
Table 4: Labour Supply and Cases and Deaths of SARS in ASEAN, Difference-in-Difference Results

	(1)	(2)	(3)	(4)
Treatment variable:	**Cases**	**Cases**	**Deaths**	**Deaths**
DiD coefficient	0.000053	–0.000051	0.00032	–0.00033
	[0.66]	[–0.89]	[0.64]	[–0.85]
Log GDP per capita	0.047	0.0014	0.048	0.0011
	[0.35]	[0.039]	[0.35]	[0.032]
Year fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Country-specific time trend	Yes	Yes	Yes	Yes
Observations	317	317	317	317
R-squared	0.98	0.94	0.98	0.94

ASEAN = Association of Southeast Asian Nations, DiD = difference-in-difference, GDP = gross domestic product, SARS = severe acute respiratory syndrome.
Note: Robust t-statistics clustered at the country level in brackets.
Source: Author's calculations based on World Bank (2021).

Figure 5 shows the DiD estimator results for regressions, showing different lengths of treatment from 1 year, starting in early 2003, to 17 years (ranging from 2003 to 2019); 95% confidence intervals are produced surrounding each point estimate. The results in Table 3 are captured by the right-most point estimate and confidence intervals.

Figure 5: Labour Supply and SARS in ASEAN, Difference-in-Difference Results by Year, 95% Confidence Intervals



ASEAN = Association of Southeast Asian Nations, SARS = severe acute respiratory syndrome.
Notes: Point estimates are from a difference-in-difference estimator that captures the duration of treatment from 1 year (2003) to 17 years (2019). Bars represent 95% confidence intervals. The dependent variable is the log of female and male labour force participation rates, respectively. Regressions include country and year fixed effects as well as country-specific time trends. Regressions control for gross domestic product per capita (log).
Source: Author's calculations based on World Bank (2021).

Figure 5 highlights that the SARS epidemic had a statistically significant effect on the labour supply of women, but not of men, in the short term. The figure shows that after 1–4 years of treatment (i.e. exposure), the female labour supply was negatively affected by SARS. Experiencing SARS decreased women's labour supply by 2%–6% during the first year of exposure. The effect remains visible in the affected economies for approximately 5 years after the end of the SARS epidemic.

The pattern depicted in Figure 5 suggests that even a relatively small epidemic – that did not cause the same level of economic devastation as COVID-19 – can have prolonged labour market effects and that these effects are gendered. One plausible explanation for women bearing a greater cost may be related to the fact that social distancing measures disproportionately affect women. The COVID-19 pandemic, for example, heavily affected the hospitality and retail sectors, which

predominantly hire women (ILO, 2020). The SARS epidemic also disproportionately affected those same sectors (Chou, Kuo, and Peng, 2004; Hai, Zhao, Wang, and Hou, 2004; Siu and Wong, 2004).

Furthermore, as with COVID-19, part of the SARS public health response for some affected countries was to close schools; it is also plausible that some parents pulled children out of school (James et al., 2006). School closures can disproportionately affect women due to their role as primary caregivers. Recent evidence from the United States suggests that caregiving responsibilities during the COVID-19 pandemic has put pressure on women to reduce their labour supply (McKinsey, 2020). The evidence shows that even short-term closures can have important effects on the labour supply.

7.1.3 Remittances and SARS in ASEAN Countries

Table 5 presents the DiD results describing the relationship between SARS and remittances (logged). The DiD estimator shows that countries that experienced SARS were not more or less likely to experience a change in remittances.

Table 5: Remittances and SARS in ASEAN, Difference-in-Difference Results

	(1)	(2)	(3)	(4)	(5)
DiD estimator	–0.13	–0.27	–0.050	–0.088	0.37
	[–0.69]	[–1.25]	[–0.19]	[–0.38]	[1.51]
Log GDP per capita	–0.99***	–1.24***	0.22	–1.43***	–0.73
	[–3.75]	[–3.66]	[0.91]	[–4.71]	[–0.91]
Year fixed effects	No	Yes	No	Yes	Yes
Country fixed effects	No	No	Yes	Yes	Yes
Country-specific time trend	No	No	No	No	Yes
Observations	280	280	280	280	280
R-squared	0.37	0.54	0.78	0.85	0.88

ASEAN = Association of Southeast Asian Nations, DiD = difference-in-difference, GDP = gross domestic product, SARS = severe acute respiratory syndrome.
Note: Robust t-statistics clustered at the country level in brackets.
Source: Author's calculations based on World Bank (2021).

In Table 6, whether this result holds is tested using cases of SARS and deaths. The results remain unchanged.

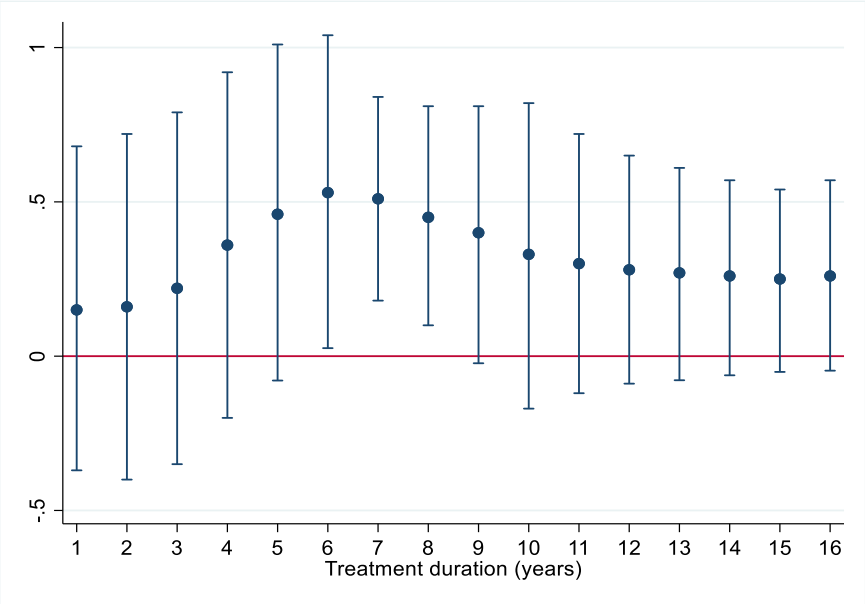
Table 6: Remittances and Cases and Deaths of SARS in ASEAN, Difference-in-Difference Results

	(1)	(2)
Treatment variable:	**Cases**	**Deaths**
DiD estimator	0.0074	0.097
	[1.81]	[1.50]
Log GDP per capita	–0.85	–0.80
	[–1.11]	[–1.04]
Year fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
Country-specific time trend	Yes	Yes

ASEAN = Association of Southeast Asian Nations, DiD = difference-in-difference, GDP = gross domestic product, SARS = severe acute respiratory syndrome.
Note: Robust t-statistics clustered at the country level in brackets.
Source: Author's calculations based on World Bank (2021).

Figure 6 replicates the exercise summarised in Figure 5, but with a focus on remittances. The figure highlights that the SARS epidemic had a statistically insignificant effect on remittances in both the short and long term. However, there is evidence that suggests a positive effect in the medium term – 6–8 years after the epidemic – possibly due to households using remittances during the economic recovery at the end of the epidemic.

Figure 6: Remittances and SARS in ASEAN, Difference-in-Difference Results by Year



ASEAN = Association of Southeast Asian Nations, SARS = severe acute respiratory syndrome.
Notes: Point estimates are from a difference-in-difference estimator that captures the duration of treatment from 1 year (2003) to 16 years (2018). Bars represent 95% confidence intervals. The dependent variable is the log of remittances as a share of gross domestic product. Regressions include country and year fixed effects as well as country-specific time trends. Regressions control for gross domestic product per capita (log).
Source: Author's calculations based on World Bank (2021).

8. Conclusions

This study used data from the 2003 SARS epidemic to highlight how a global pandemic can affect labour supply and remittances in ASEAN economies. The study showed a small, yet negative and statistically significant relationship between remittances and the female labour supply.

The study then exploited the notion that, within ASEAN, the SARS epidemic behaves as a natural experiment to test the effect of a pandemic on the labour supply and remittances, respectively. Not all ASEAN countries had SARS cases, which means that a control group could be sourced from the remaining economies. Therefore, a DiD approach was adopted to estimate the role of remittances and labour supply in a pandemic.

DiD regressions were then estimated for different lengths of treatment to capture the fact that while the health shock associated with SARS only lasted 1

year, its economic consequences were potentially longer. The results showed that the SARS epidemic had a statistically significant and negative effect on the labour supply of women, but not of men, in the short term. After 1–4 years of treatment, the female labour supply was negatively affected by SARS by 2%–6%.

The findings suggested that even a relatively minor epidemic that only lasted about 7 months can have long-lasting effects on the labour supply, possibly because women bear a greater cost from social distancing measures, which disproportionately affect sectors that predominantly hire women, and public health responses, such as school closures, which disproportionately affect women due to their role as primary caregivers.

A similar exercise revealed that the SARS epidemic significantly and positively affected remittances into affected ASEAN economies in the medium term – 6–8 years after the end of the epidemic. This may have resulted from households using remittances during the period of economic recovery after the pandemic.

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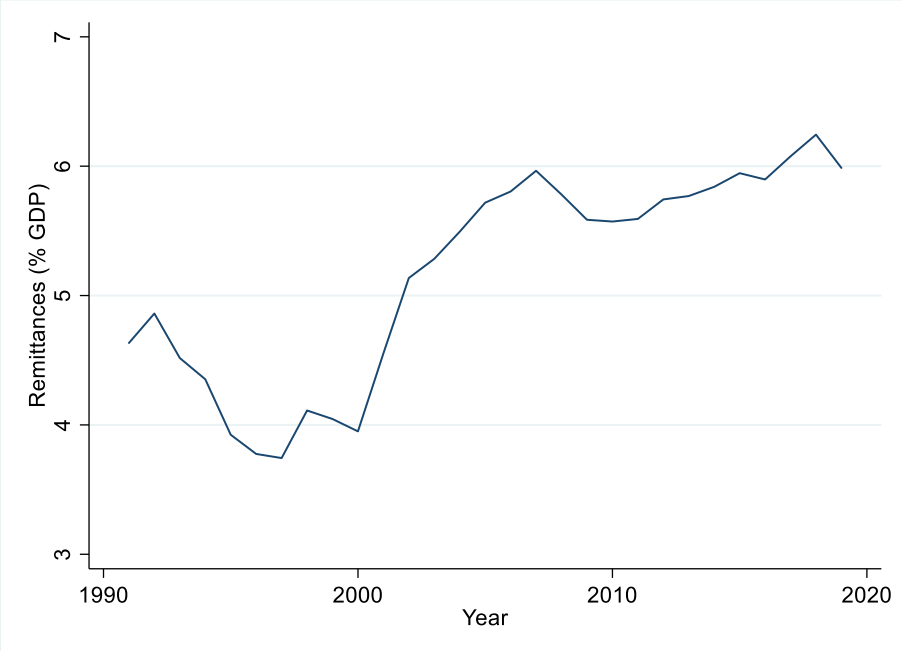
Appendix: Remittances and Labour Supply across Countries

This appendix uses international data sources to study the effects of remittances on the labour supply. The sample is limited by data availability; however, most major developing economies in the Middle East and Africa, Asia and the Pacific, Latin America and the Caribbean are represented. Altogether, 130 countries are included. Due to data availability, the period of analysis concentrates on 1990–2019.

Figure A1 shows average remittances into these countries over the period. Remittances are defined as in the main text. Figure A2 shows labour force participation rates of women and men, respectively, averaged across the 130 countries.

Figure A1: Remittances as a Share of Gross Domestic Product

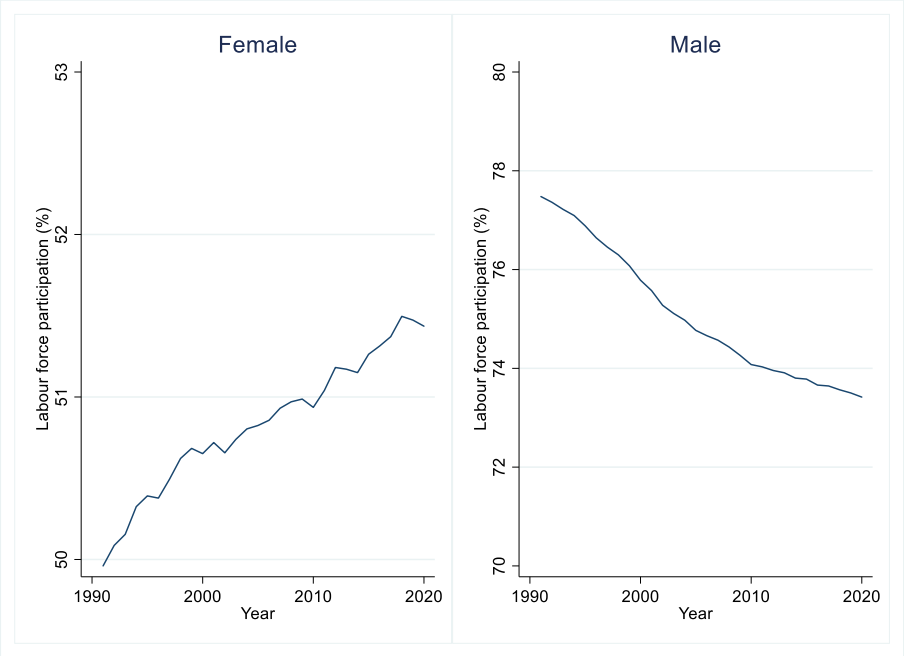
(%)



Notes: Average remittance inflows to 130 developing countries.
Source: World Bank (2021).

Figure 2: Female and Male Labour Force Participation

(% of population)



Notes: Average rates of 130 developing countries. Labour force refers to those age 15 years and over.
Source: World Bank (2021).

In the econometric analysis, economic development is included as an important confounder of the labour supply–remittances relationship. The gross domestic product (GDP) per capita measured in 2010 US dollars is included. Table A1 presents the summary statistics of the data described above.

Table A1: Summary Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Female labour force participation (%)	3,222	50.59	17.73	5.98	87.86
Male labour force participation (%)	3,222	75.12	8.80	43.79	94.48
Remittances (% GDP)	3,222	5.21	9.36	0.00	167.43
GDP per capita (2010 US$)	3,222	3.93	4.09	0.16	27.15

GDP = gross domestic product.
Note: Data for 130 developing countries.
Source: World Bank (2021).

The baseline empirical model involves estimating an equation that captures the impact of remittances on the labour force participation rates of males, females, and the entire population. This can be analysed using the following equation:

$$LF_{i,t} = \beta_1 R_{i,t} + \beta_2 Y_{i,t} + \alpha_i + \lambda_t + \varepsilon_{i,t}, \qquad \text{(A1)}$$

where $LF_{i,t}$ refers to the labour force participation of males and females, for country i at time t. $R_{i,t}$ is remittances as a share of GDP, while the term $Y_{i,t}$ is GDP per capita, which proxies for the average national income, which is deemed an important confounder in the remittances–labour supply relationship. The term α_i is a country fixed effect, λ_t is a year fixed effect, and $\varepsilon_{i,t}$ is a normally distributed mean-zero error term.

In another specification, country-specific time trends are included to account for various government policies or internal shocks that can potentially impact labour supply within countries. Including these augments Equation (A1) as follows:

$$LF_{i,t} = \beta_1 R_{i,t} + \beta_2 Y_{i,t} + \alpha_i + \lambda_t + t \cdot \alpha_i + \varepsilon_{i,t}, \qquad \text{(A2)}$$

where $t \cdot \alpha_i$ is a country-specific time trend.

Table A2 presents the fixed effects results. Panel A shows the results pertaining to Equation (A1), the baseline model. Panel B adds country-specific time trends, as specified in Equation (A2). All regressions are estimated using robust standard errors clustered at the country level and include country and year fixed effects.

The results across both panels are consistent. Remittances do not seem to be correlated with female labour force participation rates at the aggregate level. Rather, the table shows evidence that remittances have an overall positive relationship with male labour force participation. Panel B, for example, suggests that an increase in remittances as a share of GDP by 10 percentage points is associated with an increase in male labour force participation by approximately 0.4 percentage point.

Table A2: Fixed Effects Results

	(1)	(2)
	Female	**Male**
Panel A: Baseline model		
Remittances	0.044	0.043***
	[1.51]	[3.11]
GDP per capita	0.54**	0.22
	[2.57]	[1.65]
Observations	3,222	3,222
R-squared	0.07	0.25
Panel B: Baseline + country specific time trend		
Remittances	–0.013	0.037***
	[–0.85]	[3.06]
GDP per capita	0.49**	0.011
	[2.13]	[0.035]
Observations	3,222	3,222
R-squared	0.78	0.79

GDP = gross domestic product.

Notes:

1. Robust t-statistics clustered at the country level in brackets.
2. *, **, and *** denote 10%, 5%, and 1% levels of significance, respectively.
3. All regressions include country and year fixed effects.

Source: Author's calculations based on World Bank (2021).

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