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Impact of Covid-19 on the Economic Situation of Women in the Non-Formal Sector in Southern Benin

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Abstract The Covid-19 pandemic has posed one of the most significant challenges globally over the past five years, straining public policies and hindering access to essential services, particularly for women. This article aims to evaluate the pandemic's impact on the economic situation of women in the informal sector in southern Benin. Data were sourced from a household survey conducted among households with members aged 15-64 as part of the "Rise Bénin" project, funded by the Women Rise program (Canada). The Seemingly Unrelated Bivariate Probit Regression (SURE probit) model was employed to simultaneously analyze the impact of Covid-19 on income and employment loss. The findings reveal that response measures, such as the cordon sanitaire (COSAN) and the closure of entertainment venues, significantly increased the probability of income and employment loss among women. Sustainable post-Covid-19 recovery strategies must incorporate public policies with support measures specifically tailored to the needs of women in the sectors most affected by the pandemic.

Keywords Non-formal sector, Women, Covid-19, Income, Employment

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Introduction

The Covid-19 pandemic has created an unprecedented global economic crisis, profoundly affecting the economies worldwide, regardless of their level of development. Containment measures, business closures, and supply chain disruptions caused a significant economic slowdown, leading to recessions in many regions. According to the International Monetary Fund (IMF), the global economy shrunk by 3.5% in 2020, marking the worst economic crisis since the Great Depression.^[1]

The economic impact of the pandemic varied considerably across regions and countries, depending on factors, such as economic structure, the resilience of healthcare systems, and governments' response capacities. Advanced economies were often more equipped to implement large-scale fiscal and monetary support measures, while developing countries faced more severe budgetary constraints and limited response capacities.^[2]

Harmonized data from the World Bank's high-frequency telephone surveys in developing countries indicate that the pandemic had wide-ranging effects on incomes, employment and human capital.^[2] It exacerbated existing economic and social inequalities, disproportionately impacting non-formal workers, small and medium-sized enterprises (SMEs), and sectors such as tourism and hospitality, which heavily rely on interpersonal interactions.^[3,5] Additionally, disruptions to global supply chains highlighted the vulnerability of interconnected economies, particularly affecting countries reliant on raw material exports and essential goods imports.^[6]

In sub-Saharan Africa, the non-formal sector is crucial, accounting for 70% to 90% of total employment in some countries. Women are particularly overrepresented in this sector, often engaged in activities such as street trading, subsistence farming, and domestic services.^[7] Even before the Covid-19 pandemic, these women faced challenges, including unstable incomes, limited access to financial services, and a lack of social protection.^[7] The pandemic amplified these vulnerabilities, highlighting their precarious economic situation.

In Benin, the non-formal sector is vital to the national economy, accounting for about 90% of total employment and significantly contributing to the Gross Domestic Product (GDP).^[8] The restrictive measures implemented to control the spread of Covid-19 virus had devastating effects on non-formal economic activities. The official response, including the closure of markets and public spaces, particularly affected women, whose incomes depend mainly on daily sale of goods and services.^[9] A study conducted by the United Nations Development Programme revealed a 23.8% drop in income for wage earners in the non-formal private sector during the pandemic.^[10] This income loss led to increased food insecurity and made it difficult for many families to meet their basic needs.

In addition to direct economic losses, women in Benin's non-formal sector also faced a greater domestic burden during the pandemic. The closure of schools and day-care centers forced many women to reconcile work with domestic and caregiving responsibilities, limiting their income-generating ability.^[11] This situation underscored the economic vulnerability of women in the non-formal sector and the need for in-depth analysis of the pandemic's impact on their economic situation and livelihoods.

This article aims to assess the impact of Covid-19 on the economic situation of women in the non-formal sector in southern Benin, based on an in-depth analysis of income and employment losses among women aged 15-64 during the crisis period.

Background

The Covid-19 pandemic has caused unprecedented disruption to the global economy, particularly affecting vulnerable groups. Among these, women working in the non-formal sector have suffered disproportionate impacts due to the precarious and often unregulated nature of their work. This literature review explores various dimensions of this impact.

Containment measures and movement restrictions significantly reduced economic activity. A study by the International Labour Organization showed that the non-formal sector workers witnessed an average 60% decrease in their incomes at the start of the pandemic.^[12] For women, this drop was even more pronounced due to their concentration in particularly hard-hit sectors, such as markets and local services.^[11] Based on a national study in South Africa, strict confinement had a disproportionately negative effect on women.^[13] Although, job loss due to Covid-19 affected both men and women, a significant proportion of women had to reduce their working hours, exacerbating gender inequalities in employment.

The study on the effect of Covid-19 on rural women's livelihoods in Ethiopia concluded that the pandemic significantly impacted most of their economic activities.^[14] The use of credit, inputs, and irrigation services mitigated the pandemic's impact, while reliance on remittances, being in a female-headed household, and distance from markets exacerbated it. the impact of the pandemic on rural women's economic activities. Along the same lines, a significant drop in incomes for women working in Bangladesh's non-formal sector was noted.^[13] Women in industry were particularly hard hit, facing low wages and precarious employment, which increased their exposure to economic instability and the indirect effects of social norms governing gendered labor divisions within households.

The study on food system resilience amid Covid-19 disruptions, showing that threats to food security arose not from the virus itself but from income loss and reduced purchasing power due to lockdowns and business closures.^[15] Measures implemented impacted job numbers, job quality and vulnerable groups, alongside health issues, affecting labor market outcomes.^[16,18] Travel and transport restrictions also impacted labour, causing delays in agricultural activities and affecting food production and farmers' incomes.^[19]

Workers with lower education levels were particularly affected by the pandemic in several economies. Employment decline was notably pronounced in the USA among young people, those with lower education levels, and lower family incomes.^[20] Similarly, the crisis's negative market effects were more significant for young, unmarried and less-educated workers.^[21]

Social networks have been essential for disseminating information about Covid-19, public health measures, and available resources. For women in the non-formal sector, social networks and Information and Communication Technologies (ICTs) provided opportunities to maintain and adapt their economic activities. Many women craft workers and small entrepreneurs have used social networks to sell their products and services and entrepreneurs used social networks to sell their products and services and source supplies.^[3,22] This shift to online commerce helped compensate for income losses due to physical restrictions.

Entrepreneurship support initiatives helped women in the non-formal sector adapt and diversify their economic activities. Soft loans facilitated access to the capital needed to sustain and develop their businesses.^[23] Direct financial aid, such as cash transfers, subsidies and emergency allowances, was crucial in stabilizing incomes and job, offsetting some losses due to health restrictions and business closures.^[9,12] This support enabled women to meet basic needs, avoid over-indebtedness and maintain a degree of economic stability.

The Covid-19 pandemic also transformed daily life and social dynamics, significantly increasing stress levels. A substantial increase in economic anxiety during and after Covid-19's arrival in the United States, with a wide dispersion of beliefs about pandemic risk factors affecting this anxiety.^[24,26] Additionally, low-income individuals at risk of Covid-19 exposure in the workplace had a remarkably high risk of depression, anxiety and acute stress symptoms.

Data and Methods

This section presents the data source and estimation method used.

Data

The data used in this article was obtained from a survey entitled "Study of the effects of Covid-19 and the sanitary cordon on the situation of women in southern Benin".^[27] Data collection was carried out in August and September 2023 among women and men aged 15-64 as part of the, "post-Covid-19 recovery: overcoming economic difficulties and violence against women in southern Benin" abbreviated as "Rise Benin", funded by the Women Rise program (Canada). This is a mixed-method, analytical cross-sectional study, targeting two zones (the intervention zone, the sanitary cordon or COSAN zone, and the buffer/control or non-COSAN zone). The quantitative component covered 5014 households (2494 in the sanitary cordon or COSAN zone and 2520 in the control zone). The investigation zone (COSAN) includes several communes/districts in southern Benin (Cotonou, Porto-Novo, Ouidah and Abomey-Calavi), while the buffer zone (non-COSAN) includes communes in central Benin (Dassa-Zoumé, Savalou, Glazoué and Savè) [Figure 1].

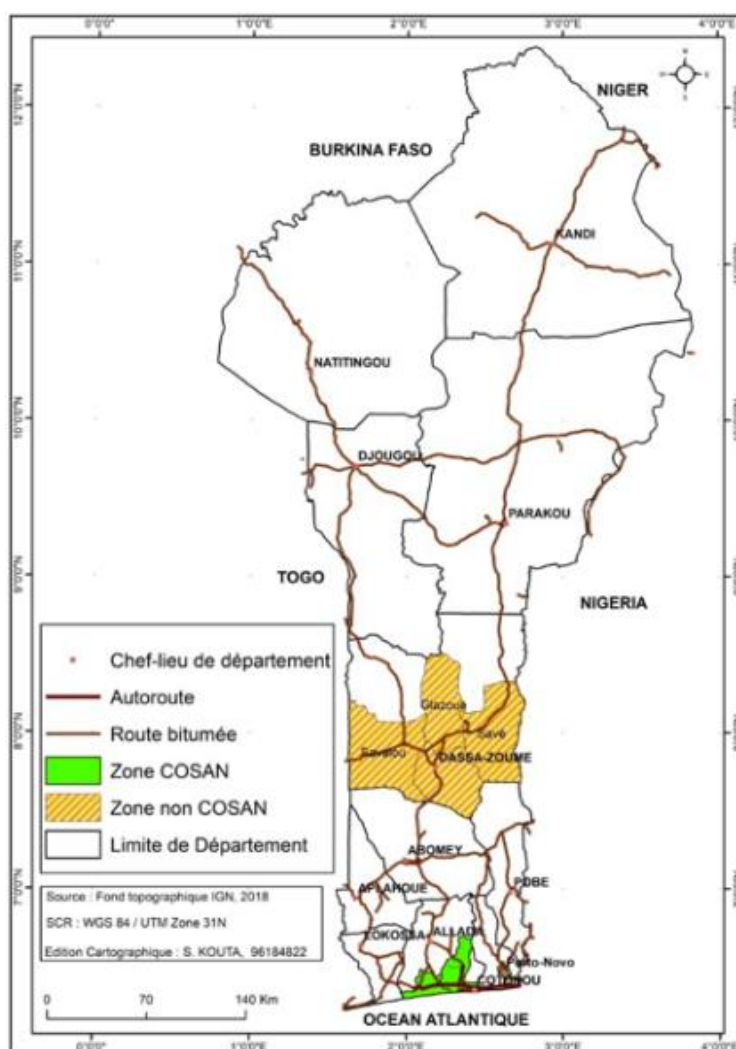


Figure 1: Map of Benin with investigation areas
Source: Rise Benin survey data, 2023

Methods

The analysis methods include a Seemingly Unrelated Bivariate Probit Regression (SURE probit) model. This model allows for simultaneous modeling of the impact of Covid-19 on income and job loss. This approach is particularly suited for examining the complex and interdependent relationships between the various economic variables affected by the pandemic.

Of the 5014 households targeted, 4931 women aged 15-64 (2429 in the COSAN zone and 2502 in the non-COSAN zone) and 2199 men aged 15-64 (1103 in the COSAN zone and 1096 in the non-COSAN zone) were interviewed. Three types of tools were used to collect data. These were the household enumeration form and questionnaires (household, woman and man) and interview guides (alleged victim of violence and resource person). Quantitative data were collected using tablets or Smartphones. For this purpose, a Survey-CTO input mask was developed for the validated collection tools. The research protocol of the study obtained the favorable ethical opinion N°172 of July 20, 2023, issued by Research Ethics Committee of the Institut des Sciences Biomédicales (CER-ISBA) in Benin. The same applies to the statistical visa n°26/2023/MEF/INStad/DCSFM of July 03, 2023, issued by the Conseil National de la Statistique (National Statistics Council - CNS) of Benin. The present research is based exclusively on quantitative data and considers 3580 women representing those engaged in income-generating activities.

Variables Used

This section describes the explained and explanatory variables used to assess the impact of Covid-19 on the economic situation of women in the non-formal sector in southern Benin.

Explained Variables

Loss of income and employment are the explained variables used to assess the impact of Covid-19 on the economic situation of women in the non-formal sector in southern Benin.

Explanatory Variables

Table 1 shows all the explanatory variables used.

Table 1: Explanatory variables selected

Variables	Rational/Definition
Affected by the effects of the sanitary cordon	A cordon sanitaire imposed to limit the spread of Covid-19 can have a direct impact on the mobility of women working in the non-formal sector. This can hinder their ability to go to markets to sell their products or access other sources of income.
Affected by the effects of border closures	Travel restrictions related to border closures may limit the ability of women in the non-formal sector to access local markets or export their products to other regions or countries. This can reduce their sales opportunities and have a direct impact on their revenue. The free movement of goods and people is enshrined within the Economic Community of West African States (ECOWAS).
Affected by the effects of the closure of places of celebration	The closure of places of celebration may lead to a decrease in the demand for goods and services offered by women in the non-formal sector, as social gatherings are limited or prohibited. This can lead to lower sales and income for these women.
Affected by the effects of school closures	Women in the non-formal sector may be forced to reduce their working hours or temporarily give up their jobs to care for children at home during school hours. This can have a direct impact on their income and economic situation.
Matrimonial situation	Marital status can influence women's access to economic resources and social safety nets. For example, women in unions may benefit from the financial support of their spouses, while single or separated/widowed women may be more dependent on their own income to support themselves.
Field of activity	Different areas of activity may be affected differently by the Covid-19 pandemic and the measures taken to contain it. For example, women working in retail may be more vulnerable to business closures and travel restrictions, while those involved in agriculture may face challenges related to the production and marketing of products.
Educational level	The level of education can influence women's employment opportunities and coping strategies.
Residential setting	Women living in rural or urban areas may have been affected differently due to differences in economic opportunities and infrastructure.
Use of social networks	Many women working in fields such as handicrafts, product sales or freelance services can leverage social media to promote their products and services. This approach allows them to maintain their activity despite the constraints of travel and physical commerce.
Benefited from the aid during Covid-19	This variable will measure the effectiveness of the support received by women in mitigating the economic effects of the pandemic, especially for women working in the non-formal sector.
Mental health (Stress, anxiety, etc.)	The impact of the pandemic on women's mental health may have repercussions on their ability to manage their economic activities.

Exposure to gender-based violence	Women exposed to forms of violence may have been further limited in their ability to work and generate income.
Parity	Child parity is a term that refers to the number of live births a woman has had. It is often used in population, maternal health, and family dynamics studies to analyze fertility trends, reproductive behaviors, and socioeconomic impacts related to family size.
Poverty/Perceived Wealth	Perceived poverty/wealth is considered here to capture the level of poverty of the household in which the woman lives.
Age	This is taken into account because the effects of Covid-19 on women's economic situation can vary greatly depending on their age. This approach allows for a more accurate analysis of the different ways in which women of different age groups are affected by the economic disruption caused by the pandemic.

Source: Authors, 2024

Estimation Method

Several techniques have been used in studies of Covid-19 to estimate its effect on socio-economic variables. These include: double difference [21,24], Ordinary Least Squares (OLS) [19,26], multivariate regression [25], and probit regression.[28]

In fact, loss of income is linked to factors other than those associated with Covid-19. These same factors may also influence job loss. In an analysis based on a simple univariate probit, an endogeneity problem may therefore arise. We model income and job loss simultaneously, using Seemingly Unrelated bivariate probit Regression (SURE probit). Considering that loss of income and job are dichotomous variables, we specify the following simultaneous latent equation models:

$$PR_i = 1\{\alpha_2 X_{1i} + \beta_1 PE_i + \varepsilon_{1i} > 0\} \quad (1)$$

$$PE_i = 1\{\alpha_2 X_{2i} + \varepsilon_{2i} > 0\} \quad (2)$$

$$\text{Avec } \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \rightarrow N \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix} \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right]$$

Loss of income (PR_i) is a binary variable that takes the value 1 if the woman loses income during the Covid-19 pandemic period and 0 otherwise. Similarly, job loss (PE_i) is a binary variable that takes the value 1 if the woman loses her job during the Covid-19 period and 0 if not. X_{1i} and X_{2i} are matrices of variables that affect the explained variables (loss of income, job loss). Since equations (1) and (2) contain endogenous regressors, the simple probit model is not suitable for simultaneously obtaining unbiased estimators. We therefore estimate these equations using the bivariate probit method, which solves the problems of unobserved heterogeneity, endogeneity and correlation. Equations (1) and (2) can also be estimated directly by the two-step method of Heckman, but interpretation of the estimated coefficients can be tedious.[29] We therefore decided to use the following alternative method to estimate the reduced forms of equations (1) and (2).

$$PR_i = \pi_1 X_{1i} + \mu_{1i} \quad (3)$$

$$PE_i = \pi_2 X_{2i} + \mu_{2i} \quad (4)$$

We estimate equations (3) and (4) with the bivariate probit model, specified as follows:

$$PR_i = \begin{cases} 1 & \text{if } PR_i^* > 0 \\ 0 & \text{if } PR_i^* < 0 \end{cases}$$

$$PE_i = \begin{cases} 1 & \text{if } PE_i^* > 0 \\ 0 & \text{if } PE_i^* < 0 \end{cases}$$

The covariance of the reduced form is $cov(\mu_{1i}, \mu_{2i}) \neq 0$. To check the correlation between the dependent variables, we test the significance of Rho (ρ), which represents the correlation between the errors of the two probit models. If $\rho = 0$, estimation of each equation by the standard probit method would give the same result as simultaneous estimation. In the case where $\rho \neq 0$, simultaneous estimation using the bivariate probit method (SURE Probit) is required. STATA 17

software is used to estimate the effect of Covid-19 on the economic situation of women in the non-formal sector in southern Benin, and the results are interpreted at the 5% significance level.

Results

This section describes the sample according to the explained variables, the descriptive and econometric statistics of the analysis of the impact of Covid-19 on the economic situation of women in the non-formal sector, and the associated interpretations.

Description of Sample by Explained Variables

Table 2 presents the absolute and relative frequencies of income loss and job loss among a sample of 3,580 observations. It shows that 72.88% of women suffered a loss of income, while 28.69% of women lost their job.

Table 2 : Descriptive statistics

Variables	Modalities	Absolute Frequency (%)
income loss	No	971 (27.12)
	Yes	2609 (72.88)
employment loss	No	2553 (71.31)
	Yes	1027 (28.69)
Comments		3580

Source: Rise Benin survey data, 2023

Descriptive Analysis

Table 3 shows the descriptive statistics of the variables used and the Chi-square test. The Chi-square test is used here to analyze the relationship between the explanatory and explained variables. Analysis of this table shows that all the explanatory variables, with the exception of level of education, Covid-19 assistance, exposure to violence and poverty/perceived wealth, are linked to income loss. In the case of job loss, all explanatory variables (except child parity and poverty/perceived wealth) are associated with job loss.

The results of the descriptive analysis indicate that 84.5% of women affected by the sanitary cordon experienced a loss of income, compared with 58.8% of those not affected. With regard to job, 36.8% of women affected by the cordon lost their jobs, compared with 18.9% of those not affected. Among women affected by border closures, 82.8% suffered an income loss. In terms of job, 35% of women affected lost their jobs.

In addition, for women affected by the closure of places of entertainment, 80.6% reported an income loss during the pandemic. For job loss, this proportion was 34.7%. These results indicate the importance of entertainment venues as a source of income and job for women in the non-formal sector. Among women affected by the school closures, 80.2% lost their income, compared with 64.4% for those not affected. In terms of employment, 36.1% of women affected by school closures lost their jobs, compared with 20.1% of those not affected.

In terms of marital status, 58.3% of single women lost their income, compared with 73.4% of those in common-law relationships and 76.73% of those separated or divorced. When considering job loss, only 19.9% of single women experienced job loss.

Women working in agriculture and livestock farming, as well as in trade and crafts, were largely affected by income loss. Nearly three-quarters (70.6%) of women farmers, 71.3% of craftswomen and 76.3% of shopkeepers surveyed said they had suffered a drop in income. On the other hand, the proportion of job losses was low and similar in all four sectors (agriculture/livestock, crafts, trade, service).

Educational level showed no significant differences for loss of income or job. In fact, the proportions of women experiencing income loss were relatively close, ranging from 72.4% to 73.9% for women with no education, and those with primary, secondary or higher education. The same is true for job loss, although the proportions are three times lower.

In urban areas, 80.7% of women have lost their income, compared with 67.9% in rural areas. With regard to job, 37.4% of urban women have lost their jobs, compared with 23.4% in rural areas. This situation may be due to the concentration of economic activities in urban areas. Among the vast majority (70.8%) of women who don't use social networks, a significant proportion (72.9%) have experienced an income loss.

The results also reveal that the vast majority of women (92.9%) did not receive any assistance during the Covid-19 pandemic. Of these, a large proportion reported an income loss (72.9%), while only 28.1% lost their jobs. Additionally, a significant proportion of women suffered stress and anxiety (70.5%) during the pandemic. Among these women, the vast majority suffered an income loss (83.6%), while only 33.9% lost their jobs.

On another note, a very small proportion (1.5%) of women were exposed to gender-based violence during the Covid-19 pandemic. A high proportion of the women surveyed in this study live in poor areas (49.1%). Proportions of income loss are quite high in all categories, with "very poor", "poor" and "very rich" areas showing similar proportions, respectively 70.8%, 71.9% and 71.4%.

In terms of age, the results show that women aged 30 to 49 are the most affected by loss of income (77.1%), followed by those aged 50 to 64 (76.6%). Young women aged 15 to 29 are the least affected, with a proportion of 63.3%.

Table 3: Descriptive statistics

Variables	Modality	Relative Frequency	Income loss		Chi2	Job Loss		Chi2
			Not	Yes		Not	Yes	
Affected by the effects of the sanitary cordon	Not	45.31	41.18	58.82	296.63	81.07	18.93	138.09
	Yes	54.69	15.47	84.53	***	63.23	36.77	***
Affected by the effects of border closures	Not	56.01	34.91	65.09	139.91	76.31	23.69	55.61*
	Yes	43.99	17.21	82.79	***	64.95	35.05	**
Affected by the effects of the closure of places of celebration	Not	31.31	44.07	55.93	237.07	84.57	15.43	140.15
	Yes	68.69	19.40	80.60	***	65.27	34.73	***
School closures	Not	46.40	35.58	64.42	112.15	79.89	20.11	111.47
	Yes	53.60	19.80	80.20	***	63.89	36.11	***
Matrimonial situation	Bachelor	4.22	49.67	50.33	43.00**	80.13	19.87	6.00**
	Cohabitation	81.62	26.63	73.37	*	70.91	29.09	
	Separate	14.16	23.27	76.73		71.01	28.99	
Field of activity	Agriculture	26.42	29.39	70.61	41.89**	76.85	23.15	24.32*
	/Breeding				*			**
	Handicraft	14.58	28.74	71.26		68.39	31.61	
	Commerce	52.96	23.73	76.27		68.83	31.17	
Educational level	Service	6.03	43.06	56.94		75.93	24.07	
	None	47.26	27.60	72.40	0.66	70.98	29.02	0.20*
	Primary	26.23	27.16	72.84		71.78	28.22	
	Secondary	24.08	26.10	73.90		71.46	28.54	
Middle	Upper	2.43	27.59	72.41		71.26	28.74	
	Rural	61.20	32.09	67.91		76.63	23.37	

Variables	Modality	Relative Frequency	Income loss			Job Loss		
			Not	Yes	Chi2	Not	Yes	Chi2
	Urban	38.80	19.29	80.71	70.37** *	62.92	37.08	78.09* **
Use of social networks	Not	70.89	29.47	70.53	24.34** *	73.33	26.67	17.27* **
	Yes	29.11	21.40	78.60		66.41	33.59	
Aide Covid-19	Not	92.96	27.04	72.96	0.15	71.91	28.09	8.10***
	Yes	7.04	28.17	71.83		63.49	36.51	
Mental health (Stress, anxiety, etc.)	Not	29.47	52.80	47.20	498.78 ***	83.70	16.30	112.13 ***
	Yes	70.53	16.40	83.60		66.14	33.86	
Exposure to gender-based violence	Not	98.46	27.26	72.74	2.26	71.52	28.48	4.71**
	Yes	1.54	18.18	81.82		58.18	41.82	
Child parity	Less than 4 children	71.82	28.51	71.49	8.883** *	72.07	27.93	2.577
	More than 4 children	28.18	23.59	76.41		69.38	30.62	
Perceived poverty/wealth	Poor	7.57	29.15	70.85	10.987 **	72.69	27.31	2.931
	Poor	49.05	28.08	71.92		70.84	29.16	
	Medium	39.47	24.70	75.30		71.05	28.95	
	Rich	3.72	36.09	63.91		77.44	22.56	
	Very rich	0.20	28.57	71.43		71.43	28.57	
Age	15-29 years old	29.89	36.73	63.27	71.29** *	76.82	23.18	25.62* **
	30-49 years old	52.29	22.92	77.08		68.06	31.94	
	50-64 years old	17.82	23.35	76.65		71.63	28.37	
		100%	*** p<0,01, ** p<0,05, * p<0,1					

Source: Rise Benin survey data, 2023

Econometric Analysis

Table 4 presents the results of estimating the effect of Covid-19 on the economic situation of women in the non-formal sector. The first and third columns display the coefficients for the probability of income and employment loss respectively. The second and fourth columns show the respective conditional marginal effects of the two equations (3 and 4). The significant Rho value (0.617), indicates a positive correlation between the error terms in both equations, suggesting a double endogeneity of the models. This justifies the simultaneous estimation of equations (1) and (2), indicating that unobserved variables likely influence both the probability of women in the non-formal sector losing their income and their jobs.

The analysis reveals a directional effect, showing that job loss does not necessarily affect income loss among women in the non-formal sector. The primary determinants of income loss among these women include the cordon sanitaire (COSAN), the closure of entertainment venues, and mental health. The implementation of COSAN and the closure of entertainment venues reduced economic activities, diminishing work opportunities and income in several sectors. Mental health issues also affect productivity and the ability to maintain stable employment, directly influencing income. Other factors such as marital status, sector of activity, and use of social networks also significantly influence women's income loss.

Regarding job loss, additional factors such as school closures, place of residence, and Covid-19 assistance are decisive. The place of residence also affects job opportunities. The results indicate that restrictive measures significantly impacted women in the non-formal sector in southern Benin. Women affected by COSAN had a 4.5% and 8.4% higher chance of losing their income and jobs, respectively, compared to those not affected. Additionally, the closure of entertainment venues increased the probability of income loss by 3.2% and job loss by 10.6%.

Marital status also influenced the probability of income and employment loss among women in the non-formal sector during the Covid-19 pandemic. Being in a common-law union increased the probability of income loss by 7.2% and job loss by 3.3%, while being divorced or separated increased the probability of income loss by 6.9%. Working in the service sector reduces the probability of income loss by 11.4% compared to women working in agriculture and livestock farming. However, working in the trade and craft sectors increases the probability of job loss by 5.5% and 10.7%, respectively.

Furthermore, living in an urban environment increases the probability of income loss by 2.6% and job loss by 11%. Stress and anxiety increased the loss of income for women in the non-formal sector by 11.7% and increased the probability of job loss by 4.9%. Additionally, Covid-19 assistance increases the probability of job loss by 10.3%.

Women working in the non-formal sector also face risks of income loss due to their age. Women aged 30 to 49 are 3.8% more likely to lose their income compared to those aged 15 to 29, and this probability rises to 4.6% for those aged 50 to 64.

Table 4: Effect of Covid-19 on the economic situation of women in the non-formal sector

VARIABLES	(1)	(2)	(3)	(4)
	Coefficient	Conditional Marginal effect	Coefficient	Conditional Marginal effect
	Income loss		Job Loss	
Employment Loss (Ref : No)				
Yes	-0.17 (-0.338)	-0.024 (-0.043)		
Affected by the effects of the sanitary cordon (Ref: No)				
Yes	0.477*** (-0.056)	0.045* (-0.024)	0.329*** (-0.055)	0.084*** (-0.02)
Affected by the effects of border closures (Ref: No)				
Yes	0.099* (-0.058)	0.012 (-0.009)	0.009 (-0.053)	-0.005 (-0.02)
Affected by the effects of the closure of the festive areas (Ref: No)				
Yes	0.392*** (-0.056)	0.032* (-0.019)	0.375*** (-0.058)	0.106*** (-0.021)

	(1)	(2)	(3)	(4)
VARIABLES	Coefficient	Conditional Marginal effect	Coefficient	Conditional Marginal effect
	Income loss		Job Loss	
Affected by the effects of school closures (Ref: No)				
Yes	-0.026 (-0.059)	-0.014 (-0.009)	0.173*** (-0.053)	0.069*** (-0.02)
Marital status (Ref : Single)				
Cohabitation	0.501*** (-0.121)	0.072* (-0.039)	0.219* (-0.128)	0.033 (-0.046)
Divorced/Separated	0.453*** (-0.141)	0.069* (-0.04)	0.173 (-0.144)	0.02 (-0.051)
Field of activity (Ref: Agriculture/Livestock)				
Handicraft	0.035 (-0.088)	-0.011 (-0.01)	0.286*** (-0.082)	0.107*** (-0.031)
Commerce	-0.017 (-0.064)	-0.01 (-0.008)	0.143** (-0.063)	0.055** (-0.023)
Service	-0.601*** (-0.122)	-0.114** (-0.049)	0.005 (-0.124)	0.063 (-0.044)
Educational Level (Ref : None)				
Primary	0.016 (-0.063)	0.007 (-0.009)	-0.086 (-0.058)	-0.035 (-0.022)
Secondary	0.046 (-0.071)	0.011 (-0.01)	-0.091 (-0.066)	-0.039 (-0.024)
Upper	0.056 (-0.168)	0.015 (-0.019)	-0.148 (-0.162)	-0.061 (-0.057)
Environment (Ref : Rural)				
Urban	0.370*** (-0.065)	0.026* (-0.016)	0.364*** (-0.057)	0.110*** (-0.022)
Use of social media (Ref: No)				
Yes	0.074 (-0.065)	0.008 (-0.009)	0.019 (-0.058)	0.001 (-0.022)
Covid-19 aid (Ref : No)				
Yes	0.008 (-0.097)	-0.015 (-0.014)	0.257*** (-0.088)	0.103*** (-0.034)
Mental Health (Stress, Anxiety, etc) (Ref: No)				
Yes	0.834*** (-0.053)	0.117*** (-0.044)	0.341*** (-0.057)	0.049* (-0.028)

VARIABLES	(1)	(2)	(3)	(4)
	Coefficient	Conditional Marginal effect	Coefficient	Conditional Marginal effect
	Income loss		Job Loss	
Exposure to Gender-Based Violence (Ref: No)				
Yes	-0.022 (-0.222)	-0.012 (-0.035)	0.148 (-0.178)	0.061 (-0.076)
Child parity (Ref: Less than 4 children)				
More than 4 children	-0.006 (-0.063)	-0.005 (-0.008)	0.071 (-0.058)	0.028 (-0.022)
Poverty/Perceived Wealth (Ref: Very Poor)				
Poor	-0.058 (-0.094)	-0.006 (-0.012)	-0.029 (-0.092)	-0.006 (-0.035)
Medium	-0.019 (-0.098)	0.005 (-0.012)	-0.125 (-0.095)	-0.046 (-0.036)
Rich	-0.274* (-0.154)	-0.027 (-0.027)	-0.206 (-0.152)	-0.053 (-0.057)
Very rich	0.245 (-0.553)	0.011 (-0.051)	0.341 (-0.548)	0.119 (-0.212)
Age (Ref : 15-29 years)				
30-49 years old	0.313*** (-0.064)	0.038** (-0.018)	0.132** (-0.062)	0.022 (-0.025)
50-65 years old	0.363*** (-0.089)	0.046** (-0.02)	0.069 (-0.085)	-0.006 (-0.035)
Constant	-1.187*** (-0.159)		-1.877*** (-0.167)	
athrho	0.617*** (-0.213)		0.617*** (-0.213)	
Log pseudo likelihood	-3531.603		-3531.6	
Wald chi2(49)	910***		910***	
Prob > chi2	0		0	
Observations	3.580	3.580	3.580	3.580

Note: Robust standard errors in parentheses, *** p<0,01, ** p<0,05, * p<0,1

Source: Rise Benin survey data, 2023

Probability of Prediction

Post-estimation results (table 5) indicate that a woman working in the non-formal sector has a 27.2% probability of losing both her income and her job during the Covid-19 crisis. Meanwhile, the probability of a woman keeping her job without losing income is 1.5%. Similarly, the probability of losing her job while maintaining her income is also 1.5%. Women working in the non-formal sector have a 45% probability of losing their income while maintaining their job

during the Covid-19 pandemic. These results indicate that women face a high risk of financial and professional instability during the Covid-19 crisis, highlighting their vulnerability.

Table 5: Probability of prediction

Variables	Note	Average	Ecart type	Min	Max
P11	3580	0.272	0.150	0.007	0.717
P10	3580	0.451	0.115	0.025	0.693
P01	3580	0.015	0.012	0.002	0.106
P00	3580	0.015	0.012	0.002	0.106

Source: Rise Benin survey data, 2023

Discussion

The results indicate that the Covid-19 response measures have significantly affected women in the non-formal sector in South Benin. Women impacted by sanitary cordon (COSAN) were more likely to lose their income and jobs compared to those not affected. The closure of entertainment venues further increased the likelihood of income and job loss. These findings align with studies by the International Labour Organization [12], which showed that workers in the non-formal sector saw their incomes fall by an average of 60% at the start of the pandemic, and those who demonstrated that restrictive measures had a disproportionately negatively impacted women.[13] According to a study, in the first six months following the onset of Covid-19, 22% of employed women lost their employment, compared with a 10% drop in the proportion of employed men in South Africa.[30]

Furthermore, marital status influences the probability of income and employment loss among women in the non-formal sector in South Benin during the Covid-19 pandemic. These results reflect the economic vulnerability of unmarried women, who often lack strong financial and social support networks and must shoulder financial responsibilities alone, similar to other research.[30]

Working in the service sector reduces the likelihood of women losing their income, compared to those in agriculture and livestock farming. However, working in the trade and crafts sector increases the probability of job loss. These results corroborate the findings of studies that showed women are particularly affected due to their strong presence in highly affected sectors such as markets and local services, that identified Covid-19 as an opportunity for businesses in the service sector, increasing business opportunities by 88.5%.[11,31] The lesser impact on revenue loss in the service sector may be explained by a greater ability to maintain business remotely or through adaptations to the services offered, unlike agriculture and livestock farming, which are more dependent on physical presence and supply chains. The trade and craft sectors, on the other hand, are highly dependent on direct interaction with customers, and were severely affected by movement restrictions and closures imposed during the pandemic.

In terms of place of residence, living in urban areas increases the probability of income loss and job loss among women. These results are contrary to those of the study on the effects of COVID-19 on the livelihoods of rural women in Ethiopia, who noted that Covid-19 significantly impacted the economic activities of rural women. [14] This discrepancy may be explained by structural and economic differences between urban and rural settings, and the socioeconomic profiles of the countries/settings investigated (Ethiopia versus Benin). In urban areas, economic activities are often more sensitive to movement restrictions and business closures, increasing vulnerability to income and job loss. In contrast, rural women, although severely affected, may be more resilient due to greater dependence on agricultural activities and less integration into formal economic circuits, making them less sensitive to direct disruption of urban markets.

Stress and anxiety were also found to increase income and job loss. These results partly corroborate the study on "Coronavirus Perceptions and Economic Anxiety," who noted a substantial increase in economic anxiety during and after the arrival of Covid-19 in the United States, accompanied by a wide dispersion of beliefs about the pandemic's risk factors. [26] They also agree with the findings of the study on the "Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic" [32], who showed that in the year 2020, the pandemic led to a 6-27% increase in cases of major depressive disorders and 6-25% increase in cases of anxiety disorders worldwide, undoubtedly affecting economic activity. Stress and anxiety can impair productivity

and work capacity, exacerbating income and job loss. High levels of stress can affect decision-making and the ability to adapt to economic change, exacerbating the vulnerability of women in the non-formal sector.

The results also indicate that Covid-19 aid increases the probability of job loss among women in the non-formal sector. These findings contradict those of the study "COVID-19 and the world of work : Impact and policy responses" [7] which established that direct financial aid, such as cash transfers, subsidies, and emergency allowances, was crucial in stabilizing the incomes of women in the non-formal sector, offsetting some of the losses due to health restrictions and business closures. This discrepancy can be explained by several factors, including context: aid may not be sufficient create a temporary dependency that does not solve the structural problems of job loss.[33] Disruptions in the implementation of support programs can also lead to an increase in precariousness rather than a reduction.[34] Women working in the non-formal sector also face risks of income loss due to their age. Estimation results show that the risk higher for women aged 50 - 64 for income loss and 30 - 49 for job loss. These findings corroborate those of other research who showed that women working in the non-formal sector face risks of income loss due to age, job insecurity, age discrimination and wage disparities.[7].

Conclusion

The aim of this article is to assess the impact of Covid-19 on the economic situation of women in the non-formal sector in southern Benin. The results indicate that containment measures, such as sanitary cordon and closure of places of celebration, significantly increased the probability of income and employment loss among women. Marital status, sector of activity and place of residence also played crucial roles, with women in common-law unions, working in trade and crafts, or living in urban areas being particularly vulnerable. Stress and anxiety exacerbated these losses, underlining the importance of mental health in economic stability. These results highlight women's vulnerability not only to the direct effects of health restrictions but also to pre-existing socio-economic factors such as marital status and sector of activity. The contradictory results concerning the effect of Covid-19 aid underline the complexity of the economic response to the pandemic. Although financial aid can play a crucial role in stabilizing incomes, its effectiveness depends on a number of factors, including its equitable distribution and its ability to resolve the structural problems of non-formal employment.

These findings emphasize the urgent need for policymakers to design gender-sensitive recovery frameworks that integrate targeted economic support, mental health services, and equitable aid distribution to strengthen the resilience of women in the non-formal sector. It is therefore imperative that economic policies incorporate support measures specifically tailored to the needs of women in the most affected economic sectors. Inclusion of mental health in economic interventions, the effective distribution of financial support, promotion of economic resilience, and awareness-raising and education initiatives are essential to reinforce the economic stability of women in the non-formal sector and mitigate the inequalities exacerbated by the pandemic.

However, the restriction of the data to the crisis period limits the possibility of a longitudinal analysis essential to fully assess the real impact of the pandemic. As the data collected focus solely on the situation of women after the crisis, they do not allow for a comparison of conditions before and after the pandemic, which is crucial for a comprehensive impact assessment. Moreover, the cross-sectional design and focus on southern Benin's non-formal sector limit causal inference due to potential unobserved confounders, such as local economic policies or household dynamics, and restrict generalizability to other regions, sectors, or demographic groups with differing socio-economic contexts. This limitation makes it difficult to distinguish the specific effects of the pandemic from other external factors that might have influenced these women's income loss or job loss. The integration of these temporal comparisons could enrich future results by providing a more complete and accurate perspective on the impact of Covid-19 and other exogenous variables on the incomes and living conditions of women in the non-formal sector.

Conflict of Interest: None declared.

Ethical Approval: The research protocol has obtained opinion No. 172 of July 20, 2023, issued by the Research Ethics Committee of the Institute of Biomedical Sciences (CER-ISBA) in Benin. To be involved in the study, all subjects gave their free, voluntary, and informed consent through the approval of the consent form designed for this purpose. Also, an information note recalling the objectives of the study and the risks of respondents participating in the study was presented. As a prelude to field operations and in compliance with regulatory obligations, the research protocol also obtained statistical visa No. 26/2023/MEF/INStAd/DCSFM of July 3, 2023, issued by the National Statistics Council (CNS) of Benin.

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