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Article

The impact of government external debt on labor demand in Indonesia: A VECM approach through the exchange rate channel

Fatmawati[1,*], Retno Fitrianti[1], Mirzalina Zainal[1], Mayanggita Kirana[2], Omer Mohamed Taha Alkanan[3]

[1] Faculty of Economics and Business Universitas Hasanuddin, Kota Makassar 90245, Indonesia
[2] Faculty of Economics and Business Universitas Diponegoro, Kota Semarang 50275, Indonesia
[3] The Rosy City for Educational Services and Consultations, Amma 11118, Jordan
*** Corresponding author:** Fatmawati, fatmawatiwardihan@yahoo.com

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Abstract: Considering the rate of the currency channel, this study aims to analyze the effect of government foreign debt on labour demand in Indonesia. The Real Effective Exchange Rate (REER) is used to quantify the exchange rate, while estimates of the labour force participation rate characterize labour demand. this study expands upon the cobb-Douglass production function by including public debt as an integral element of the statistical model. The current study examines time series data from 1994 to 2022 and uses the Vector Error Correction Model (VECM) for estimation. in conclusion, the results suggest that an increase in government external debt would result in a decline in labour demand, especially during economic shock associated with an expansion of the government deficit. Moreover, the Real Effective Exchange Rate has a beneficial long-term impact on labour demand. enhancing the purchasing power and stimulating investment through the appreciation of the domestic currency against foreign currencies will consequently increase economic productivity.

Keywords: external debt; demand for labor; REER; productivity; VECM discipline

1. Introduction

Indonesia has a large labour force, so there is a strong need for employment opportunities that could improve citizens' quality of life. An essential factor in a country's economic progress is the growth of its productive labour force (Mankiw, 2021). From a labour demand standpoint, economic growth is essential for increasing productive employment (Andersen and Skaksen, 2007). This is the combined result of increased employment rates and worker productivity enhancements. Therefore, the economic growth rate sets the maximum limit for both the increase in employment and the increment in labour productivity (International Labour Office, 2016).

Strategic fiscal policies encouraging investment and infrastructure development are essential for economic growth. Implementing measures such as tax incentives for companies that create new job possibilities, along with the distribution of funds for labour-intensive infrastructure projects, can significantly improve employment growth. The principal aim of fiscal policy is to augment the government's ability to obtain adequate and long-lasting development funding sources. The available fiscal instruments for deployment include tax revenue and external debt, namely government debt. Public debt arises from a state of imbalance between government expenditure and revenue. The degree of actual expenditure or consumption surpasses the revenue in government control. To address this budget deficit, it is financed by increasing the amount of public debt, including foreign debt. In contrast, the potential for excessive

budget deficits or increased public debt can interfere with the general stability of the economy.

Since 2012, the Indonesian government's external debt to GDP ratio has been rising, aligning with the most recent external debt overhang during the economic recovery from the 1998 crisis shock. A significant decrease followed this increased ratio in the labour force participation rate. Throughout the current economic crisis, Indonesia's external debt increased by 3.25 percent, reaching almost 40 percent of its total output in 2020. Indonesia's external debt has increased by 62 percent compared to the previous ten years. **Figure 1** shows Debt-to-GDP ratio and labor force participation in Indonesia (1998–2022) (International Labour Office, 2016).

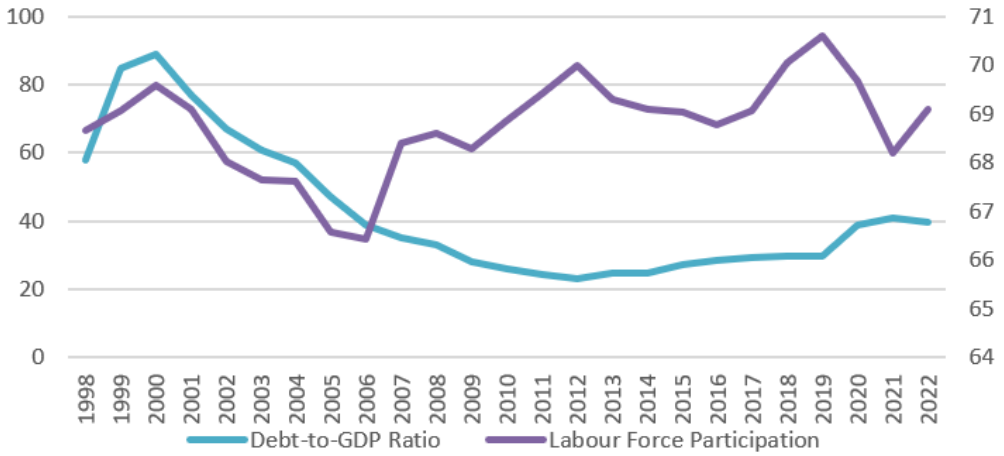

Figure 1. Debt-to-GDP Ratio and Labor Force Participation in Indonesia (1998–2022) (International Labour Office, 2016).

The significant increase in external debt in 2020 directly responded to the economic upheavals triggered by the COVID-19 pandemic, namely in the healthcare sector and the costs linked to the shift to a new standard. Under the assumption that this fiscal obligation may enhance economic growth, the Government implemented an expansionary strategy by increasing the level of debt. Every developing country wants its government debt to be productive, allowing the funded economic activities to meet interest and repayment responsibilities. However, a surplus of foreign debt that does not directly contribute to economic growth may sometimes harm the country's economy.

The substantial surge in external debt in 2020 directly reacted to the economic disruptions caused by the COVID-19 epidemic, particularly in the healthcare industry and the expenses associated with the transition to a new benchmark. Under the premise that this fiscal responsibility may potentially stimulate economic growth, the Government adopted an expansionary approach by raising the amount of debt. Every developing country aspires for its government debt to be productive, enabling the financed economic activities to fulfil the interest and repayment obligations. Nevertheless, excessive foreign debt that does not directly contribute to economic growth can also adversely affect a country's economy.

The primary aim of this study is to investigate the correlation between foreign debt and labour demand by employing the exchange rate pass-through transmission

method. The Real Effective Exchange Rate (REER) is a critical factor in calculating the amount of debt expressed in foreign currency, namely, dollars.

The Real Effective Exchange Rate (REER) could also change the prices of different parts used in production. This happens when the Real Effective Exchange Rate (REER) goes up. It makes the domestic currency go up, too, which increases the prices of Indonesian export items (García-Jiménez, 2015). Because of this, there would be less demand for Indonesian goods in foreign markets. According to García-Jiménez and Mishra (2010), when the value of the US dollar goes up, it makes manufacturing sector production less competitive, which could directly or indirectly replace foreign output. When the currency's value went up and prices changed about each other, the demand for local output went down, decreasing the demand for jobs.

This study brings several key innovations to the existing body of research on labour demand and foreign debt in emerging economies like Indonesia. First, it utilizes a unique approach by employing the Real Effective Exchange Rate (REER) pass-through mechanism to assess the impact of foreign debt on labour demand, a channel often overlooked in previous studies. By integrating the REER, this study provides a nuanced understanding of how currency fluctuations influence the cost of external debt, production inputs, and, ultimately, labour market outcomes. Additionally, the study covers a broad timeframe, including the economic disruptions caused by the COVID-19 pandemic, allowing for a comprehensive analysis of how external debt dynamics evolve during periods of crisis. Lastly, using advanced econometric techniques, such as the Vector Error Correction Model (VECM), enables the identification of both short-term and long-term impacts of foreign debt on labour demand, contributing new insights into the complex relationship between macroeconomic variables and employment in emerging markets.

2. Literature review

Menguy (2019) investigated the influence of varying degrees of public debt on the trajectory of national economic growth. Evidence suggests that increasing public debt can bolster short-term economic activity, notably in exports and public investment spending. In the short term, public debt can increase the availability of capital, raise real wages, and stimulate the supply and demand of labour. Moreover, there are barriers to the positive influence of higher public debt levels on sustained macroeconomic growth in the long run. Therefore, our study illustrates that a strong responsiveness of the nominal interest rate to a rise in public debt could negatively affect short-term economic activity. Moreover, the growing trend of the national debt could theoretically result in adverse outcomes.

The latest studies offer critical knowledge on Labour demand and migration patterns in Southeast Asia concerning exchange rates and industrial growth. Yang (2006) utilized the Asian fiscal crisis as a natural experiment, the outcome of exchange rate volatility on the return decision of migrant workers. Another similar study also points out the fact that the degree of return of the immigrants is highly influenced by currency depreciation since the value worth of the remittances reduces comparatively, hence influencing the supply of Labour in their home countries (Yang, 2017). Similarly, Amanzadeh et al. (2024) assessed the overall comprehensive database of

the transnational works completed in 180 countries to realize that boosters in the industrial development of both source and destination countries significantly influence the workers' decision to return home. These papers still emphasize factors such as exchange rate and economic growth as determinants of the mobility and demand of labour, which is very important in analyzing labour markets in Indonesia and other Southeast Asia (SEA) economies.

A study by Cahyadin and Ratwianingsih (2020) examined the relationship between foreign debt, exchange rates, and unemployment rates in ASEAN countries, including Indonesia, Malaysia, Thailand, and the Philippines, from 1980 to 2017. In order to achieve the research objectives, we utilized ARDL-ECM analysis and the Granger Causality Test. The findings indicate immediate effects in all empirical models, specifically in the independent variables of external debt, exchange rate, and unemployment. Furthermore, the stability test verifies the precision and consistency of the models. In the specific context of Indonesia, the causal link establishes a distinct sequential relationship between foreign debt, exchange rate, and unemployment. Moreover, there is a correlation between foreign debt, exchange rate, and unemployment in specifically selected ASEAN countries.

In their study, Frenkel and Ros (2006) examine the influence of Real Exchange Rate Pass-Through (RERT) on unemployment in Brazil from 1981M1 to 2015M11 by employing the Autoregressive Distributed Lag (ARDL) model. An analysis of long-term data shows that the unemployment rate reacts differently to the increase and decrease of the Real Effective Exchange Rate (REER), with the decrease having a substantial effect. Nevertheless, the effect of RERT on unemployment, both in the short and long run, is not entirely exhaustive. The results of this study have important policy implications for developing appropriate monetary policy in response to an increase in unemployment resulting from adjustments in the pass-through of the real exchange rate. Ahmad (2018) examined the impact of Foreign Direct Investment (FDI), Real Effective Exchange Rate (REER), and total labour force on Pakistan's export performance between 1990 and 2016. Vector Error Correction Model (VECM) coding is used to analyze time-varying dynamics in both the long and short term. The evidence from this analysis indicates that, over an extended period, Foreign Direct Investment (FDI) and the labour force substantially contribute to Pakistan's export growth. Nevertheless, in the immediate term, the influence of currency rates is quite efficient in boosting outbound trade. The paper suggests that the Government should aggressively encourage Foreign Direct Investment (FDI) and Trade Facilitation Services (TLF) while developing trade policies.

2.1. Labor market

Analogous to the market for commodities and services, the labour market functions based on the fundamental concepts of supply and demand. However, the essential differentiation is in the story behind the mechanisms of supply and demand. The labour provided by workers serves to produce goods and services, as they need financial resources for their daily needs, such as food, shelter, and similar essentials. On the other hand, entrepreneurs need a workforce to produce finished goods and deliver services to achieve financial profits.

The presence of labour is essential for companies to produce the requisite commodities and services. Within this context, the object of exchange in the labour market is the labour itself, while the agreed-upon "price" is the wage rate.

The presented image functions as a graphical depiction of the labour market as a whole, where wages are established by the interaction between the demand for workers and their availability as shown in **Figure 2**. An equilibrium condition of the labour market is defined by a surplus supply, which causes a downward force on wages. Conversely, an increased demand for employment will lead to a wage rise.

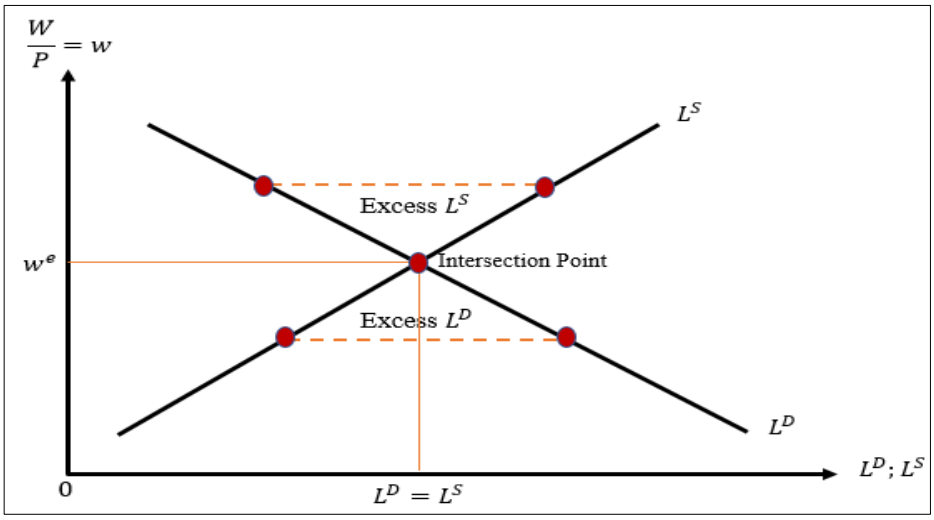

Figure 2. How labor supply and demand work together to set wages.

2.2. Labour demand

Labour demand is the unique need for labour by a particular company or agency, and achieving optimal results will need maximizing corporate profits. Labour demand and the quantity of labour available, or more accurately, the labour utilized by a company or industry, are distinct notions. Labour demand was the relationship between various wage levels and the number of persons actively seeking employment. Simultaneously, the level of labour demanded is heavily influenced by the quantity or magnitude of labour needed at a particular wage level (Володин, 2017).

The notion of human resources as labour comprises two interconnected elements: the quantity component and the quality component. Labour's quantitative component pertains to its ability to perform tasks in the market and produce commodities and services within a defined period (Amanzadeh et al., 2024). The quality component of labour can be understood by examining the capacity of labour knowledge to produce output that satisfies predetermined quality standards.

Work demand is the relationship between the paid rate of work and the anticipated amount of labour that a company plans to employ or acquire (Branson and Love, 1986). The demand for labour is intricately connected to the notion of derivative demand. Moreover, according to Campa and Goldberg (2001), labour demand is when employers' need for labour is contingent upon the increase in society's demand for the goods and services provided. Derivative demand is the demand for labour and other productive resources that depend on the demand for the commodities and services produced.

The persistence of employers in increasing the level of labour needed is contingent upon the ability of the additional workforce to generate sales of goods and services that exceed their employees' compensation. Suppose the extra labour can only provide additional output equal to the wage necessary to compensate for the additional labour. In that case, the entrepreneur will stop increasing the demand for labour. Such conditions are crucial for the company to optimize its financial gains.

Di Domenico and Russo (2022) define a labour demand curve as a graphical depiction of the maximum amount of labour an employer is willing to employ at a specific wage rate during a certain period. It is feasible to derive the labour demand curve from the Marginal Physical Product (MPP) curve. When considering the economic scale, the MPP curve is obtained from the Total Product (TP) curve, which shows a consistent upward trend until it reaches its maximum value. The peak point of the total power curve aligns with the nadir of the marginal power production curve, leading to its convergence towards zero.

2.3. Employment opportunity elasticity

Employment elasticity is the ratio calculated by dividing the change in employment growth rate by the growth rate of the overall national economy. Elasticity can be measured either at the macroeconomic level or at the level of specific market sectors. Moreover, it can be interpreted as the percentage change in the number of employees in reaction to a one per cent modification in the wage rate.

Elasticity is a statistical measure that can calculate the labour demand for a certain period at the sectoral and macroeconomic levels. Furthermore, it may be used to simulate employment development strategies by choosing different growth rates for each industry and thereafter assessing the possible job prospects that can be created (Campa and Goldberg, 2001). The elasticity's magnitude is influenced by three key factors: (1) the capacity to substitute labour with other production components; (2) the government's responsiveness to the produced goods; and (3) the ratio of employee earnings to all other costs related to complementary production.

Employment opportunity is the degree of preparedness of manufacturing companies to recruit the required workforce for production. Job market refers to the pool of employment opportunities or job openings that arise from economic activity. Employment opportunities emerge from a demand for labour in the labour market, showing the current workforce requirement (Mankiw, 2022). Expanding employment prospects is a deliberate policy effort to foster industries capable of accommodating labour with low productivity. Various factors, such as population and labour force expansion, economic growth, labour productivity levels, and policies specifically designed to improve employment prospects, determine the increase in job opportunities.

Due to economic development efforts and disparities in regional capability, each economic sector's development policies, programs, and growth rates differ. Specific economic sectors see rapid and fast growth, while others demonstrate moderate growth. Divergences in the rate give rise to fluctuations in the pace of expansion in labour productivity among several industries, resulting in incremental shifts in the assimilation of the workforce and its influence on overall economic growth. Utilizing

the elasticity of employment opportunities allows for estimating labour demand sector-wise or overall, considering the economic growth rate.

2.4. External debt

In developing nations, foreign debt can be used to get technology and other essential manufacturing resources, improving employment opportunities and overall national productive capacity. The labour force, being the main factor of production, is another important indicator of economic progress. The degree of trade openness indicates the degree to which trade liberalization promotes the efficient exchange of goods and technology in both directions inside an economy. The liberalization of foreign trade is often beneficial for economic development since it facilitates the exchange of technology and improves the flow of goods and services. From the standpoint of exporting, it can lead to higher levels of output through the utilization of more labour and capital. Furthermore, incorporating exports can lead to a more efficient allocation of resources according to comparative advantage and production efficiency, promoting economic expansion (Paudel and Perera, 2009).

Recent economic crises have been characterized by the substantial involvement of fiscal deficits, which arise from both the decline in tax collection and the implementation of policy actions by governments. Budget deficits are beneficial in times of crisis as they temporarily enable governments to get loans to alleviate shocks' impact (Bertola, 2010). During financial market failure, financial institutions and governments have restricted ability to borrow funds. Policies targeting the labour market have become highly important in the budgets of many governments. The crisis led to significant funds being allocated towards income support and job training for permanently affected individuals. Although the optimal policy response has not yet been established, it is essential to understand the long-term effects of different labour market policy instruments on labour market outcomes and debt.

Successfully controlling high unemployment and labour absorption inefficiencies depends on each country's political and economic conditions. Profound public debt levels within the same countries frequently result in a realignment of political and economic policy towards less interventionist measures in the employment market. Assuming real wages stay constant, high debt and low trust in macroeconomic policy might trigger a detrimental cycle marked by rapid debt rise, decreased employment rates, and sluggish income development. Therefore, in case of expected inflation, individuals will demand higher wages. Failure of the central bank to comply with this expectation will lead to a high real interest rate (Andersen and Skaksen, 2007; Bertola, 2010).

2.5. Real Effective Exchange Rate (REER)

The Effective Exchange Rate (EER) is crucial in global commerce and financial transactions. The study by Klau and Fung (2006) investigated the determination of aggregate pricing competitiveness or effective exchange rate, utilizing the standard reference. This benchmark measures the extent of price volatility in a country's trade industry relative to other countries once the prices of each country have been converted into their respective national currencies. The EER, according to Klau and Fung (2006),

functions as a quantitative measure for evaluating worldwide competitiveness, a component of the monetary/financial conditions index, quantifying the transmission of external shocks, an intermediate objective for monetary policy, and an operational benchmark. Calculating the Real Effective Exchange Rate (REER) involves adjusting the nominal effective exchange rate (NEER) by considering relative consumer prices. The Real Effective Exchange Rate (REER) is calculated by including an inflation component, known as the consumer price index, for each currency. This allows it to reflect the purchasing power of their respective currencies.

Several factors typical of Indonesia as a country with a developing economy determine the importance of the economic theories shown in practice. High unemployment has been an acute problem, compounded by weak employment generation and recourse to overseas employment. Most Indonesians seek employment opportunities overseas because the internal economy cannot employ increasing numbers of workers. This high proportion of overseas labour indicates deeper structural problems in Indonesia and its economy, as well as poor industrial diversification and poor investment in areas that might help create sustainable employment. Besides, fiscal policies such as the Government's external use, borrowing policies and external debt have significant roles in determining economic stability. After the Asian financial crisis of 1997–1998, Indonesia's external debt increased sharply and added further weakness to the fiscal balance and dependency on foreign capital.

Besides the high unemployment rate, Indonesia has experienced problems of currency crises characterized by the instability of the rupiah against other world currencies, affecting export and import businesses. The fluctuations in exchange rates due to global economic factors and a country's policy implications have directly impacted labour intensity and government investment. Holding the rupiah, the depreciation raises the cost of imports, and the external debt burden, inflation and, in equal measure, affects the real wages employment rate. These financial pressures, in combination with high levels of foreign debt, put forward the fact that applying and implementing the basic principles of economic sciences may not always give the complete picture of Indonesia's economy. However, a somewhat more complex approach is needed to understand how these problems—high level of unemployment, critical number of overseas workers, increasing government debt, fluctuating exchange rate, and others affect the performance of economic policies in the Philippines. This study examines these dynamics using government external debt and its effect on demand for labour with the exchange rate as a factor.

2.6. Transmission mechanism of government external debt to labor demand in Indonesia

Indeed, the Indonesian Government's external debt is best understood in its contribution to the country's economic portrait, especially in terms of the latest impact on the employment of people. Whenever a country such as Indonesia takes foreign credit to finance fiscal deficits, there is an expectation that the funds will boost outlay and stimulate economic growth and, thereby, Probable labour demand in the short term. However, the consequences of sustained debt buildup provide several issues that

may have a negative impact on the demand for labour. External debt influences the demand for labour by affecting the money balances and the general exchange rate. When moving to the second element of the model, when external debt rises, investor confidence may diminish due to concerns over the country's capacity to service its debts, hence depreciating the national currency. In Indonesia, this devaluation of the rupiah leads to lower purchasing power of wages. Consequently, domestic workers' wages are reduced in value compared to what they could earn overseas, which results in overseas employment. This constitutes labour outflow and thus lowers the national demand and supply of labour, increasing unemployment at home.

Also, the increase in external debt avails financial risk and will likely deter domestic and foreign investment. The ever-increasing debt levels may be viewed as a risk to the macroeconomic policy environment and deter foreign funding from sectors that would otherwise create employment. This decline in industrial investments, especially in those sectors that are fundamental to the growth of industries, hampers the growth of industries that would generally provide … Therefore, due to Currency depreciation, decrease in purchasing power and discouragement of investment leads to unemployment of labour in Indonesia thus eradicating the short term benefits of government expenditure by external borrowing.

2.7. Theoretical model

The labour demand function is obtained by substituting the Cobb-Douglas production function, which includes the variables of actual output (Q), capital stock (K), and labour input (N).

The coefficients α and β in Equation (1) represent factor sharing coefficients, with γ facilitating the improvement of worker utilisation efficiency in the production process. The aforementioned criteria have been employed by (Fu and Balasubramanyam, 2005; García-Jiménez and Mishra 2010; Hua, 2007).

The study model is derived by deducing the Cobb-Douglas production function, which is specified.

$$Q = A^{\gamma} K^{\alpha} N^{\beta} \tag{1}$$

Assuming economic agents would maximize their profits, the marginal productivity of labor (MP_L) coincides with the wage (w), whereas the marginal productivity of capital (MP_K) corresponds to the cost of working capital (c) as shown in Equations (2) and (3).

$$\frac{\delta Q}{\delta N} = \beta A^{\gamma} K^{\alpha} N^{\beta-1} = \mathrm{MP}_L \tag{2}$$

$$\frac{\delta Q}{\delta K} = \alpha A^{\gamma} K^{\alpha-1} N^{\beta} = \mathrm{MP}_K \tag{3}$$

Thus obtained Equations (4) and (5).

$$\beta A^{\gamma} K^{\alpha} N^{\beta-1} = w \tag{4}$$

$$\beta A^{\gamma} K^{\alpha-1} N^{\beta} = c \tag{5}$$

Then we reformulate Equations (4) and (5) for K^{α} and $K^{\alpha-1}$, that shown in Equations (6) and (7).

$$K^{\alpha} = \frac{w}{\beta A^{\gamma} N^{\beta-1}} \tag{6}$$

$$K^{\alpha-1} = \frac{c}{\beta A^{\gamma} N^{\beta}} \tag{7}$$

Proxy value $\frac{K^{\alpha}}{K} = K^{\alpha-1}$, then obtained Equations (8) and (9).

$$\frac{\left(\frac{w}{\beta A^{\gamma} N^{\beta-1}}\right)}{\frac{K}{1}} = \frac{w}{K\beta A^{\gamma} N^{\beta-1}} \tag{8}$$

$$\frac{w}{K\beta A^{\gamma} N^{\beta-1}} = \frac{c}{\alpha A^{\gamma} N^{\beta}} \tag{9}$$

(MPL = MPK) By cancelling out N^{β}, A^{γ} obtained Equation (10) as shown below.

$$K = \frac{w\alpha N}{c\beta} \tag{10}$$

Rewrite Equation (1) by replacing the value K from Equation (10), then obtained Equation (11) as shown below.

$$Q = A^{\gamma} \left(\frac{w\alpha N}{c\beta}\right)^{\alpha} N^{\beta} \tag{11}$$

Equation (10) is then transformed by logarithm sing it to become Equation (12) as shown below.

$$N = \psi_0 + \psi_1 \ln Q + \psi_2 \left(\frac{c}{w}\right) \tag{12}$$

where $\psi_0 = \frac{-\gamma \ln A}{\alpha+\beta}; \psi_1 = -\frac{1}{\alpha+\beta}; \psi_2 = \frac{\alpha}{\alpha+\beta}$. It is assumed that efficiency parameter A is affected by government debt, so we can say that $A = e^{\psi_3 T} \text{Debt}^{\psi_4} ER^{\psi_5}$. Therefore, there is an augmentation of the demand function Equation (13) as follows:

$$N = \psi_0 + \psi_1 \, ln \, Q + \psi_2 \left(\frac{c}{w}\right) + \psi_3 T + \psi_4 \ln \text{Debt} + \psi_5 \ln \text{ER} \tag{13}$$

To anticipate the multicollinearity problem, the econometric Equation (14) in this study is:

$$N = \psi_0 + \psi_1 \ln Q + \psi_2 \ln \text{Debt} + \psi_5 \ln \text{ER} + e_t \tag{14}$$

2.8. Theoretical mechanism: Impact of foreign debt on labor demand

Foreign debt interacts with labour demand through several different economic mechanisms that can make up the employment situation of a country such as Indonesia. In the short run, foreign debt increases the demand for labour through the public investment route. Governments in developing countries rely on external sources

of funds to fund large infrastructural projects and social and other development activities that would, in the process, create employment opportunities. These raise employment opportunities in construction, manufacturing, and service subsectors as industries react to the uplifting of economic activity. External borrowing also creates capital to solve employment stressors, improve wages, and improve labour market standards. Such a short-term increase in employment is most suitable for emerging economies where public sector investment plays a significant role.

Nevertheless, a discussion on foreign debts and their effects on labour demand is far from ending, and their future impacts are more pessimistic. When external debt stock is incurred, the cost of servicing this debt in terms of interest and amortization detracts fiscal resources from productive investments. This freighting may lead to crowding out where the public sector is used to finance such costs instead of supporting industrial growth and employment opportunities.

Furthermore, macroeconomic instability is more likely to occur through the exchange rate if there is a significant level of foreign debt. A high level of external debt tends to affect the country's currency, hence depreciation negatively. Devaluation, or the weaker dollar, increases the prices of imported raw materials, machinery, equipment, and technology, dampening industries' ability to offer employment and maintain employees. Moreover, this depresses the real wages of domestic workers since their value is pegged on the dollar by opting for employment overseas, making the domestic labour supply even scarcer than before. Both these forces establish that though demand for labour rises with foreign debt in the short run, it has a longer-term constraining effect on employment generation and a decline in real wages and industrial development, which, after all, translates into a net negative impact on demand for labour.

3. Research methods

The present study employs dynamic specification to examine the influence of GDP, foreign debt, and real effective exchange rate on labour demand in Indonesia. The Mathematical model is derived using the Vector Error Correction Model (VECM) approach. This model is a statistical method used to analyze time series data, capable of capturing both the state of long-term equilibrium and short-term fluctuations. To find the most suitable trend pattern and determine the technique for the subsequent estimation, time series data is pre-tested using the stationarity test, cointegration test, and Granger-Causality test.

An initial investigation of stationarity was conducted using the Augmented Dickey-Fuller (ADF) test method, created by Dickey and Fuller (1979). This analysis aims to ascertain whether the data used in the study has attained stationarity. Upon confirming stationarity, the subsequent task is to conduct a cointegration test. Therefore, this test is essential for establishing a long-term relationship between the studied variables (Engle and Granger, 1987). The present study employed the cointegration test to assess the existence of a durable association among GDP, external debt, and Real Effective Exchange Rate in connection to labour demand in Indonesia's context.

Data sources

The data used in this study is sourced from multiple reputable institutions to ensure accuracy and reliability. Time series data for GDP, external debt, and the real effective exchange rate (REER) are collected from Indonesia's Central Bureau of Statistics (Badan Pusat Statistik), the World Bank, and the International Monetary Fund (IMF). These institutions provide comprehensive and updated economic indicators for analyzing the relationships between labour demand, GDP, foreign debt, and REER. The data spans 1994 to 2022, covering pre- and post-crisis periods to capture Indonesia's full dynamics of economic fluctuations. Labour demand data is sourced from Indonesia's Ministry of Manpower, ensuring precise information on employment trends across various sectors. All data are converted to a standard format to facilitate consistent analysis, with adjustments made for seasonality and inflation where appropriate.

The econometric model is formulated as a vector error correction (VECM) model, which involves incorporating variables and detecting shared dynamics in the data. The utilized data model is represented in Equation (15) below as follows:

$$\Delta y_t = \alpha(\beta y_{t-1} + \mu + p_t) + \sum_{j=1}^{p=1} \pi \Delta y_{t=j} + \gamma + \tau_i + \varepsilon_t \tag{15}$$

The data exhibits a steady trend and a stationary cointegrating equation around the non-zero mean when zero assumptions for ρ and τ are made (Enders, 2012). The error term ε is hypothesized to conform to a Gaussian distribution with standard properties. The parameters α and β denote the error correction term and the long-term estimate of the equation, respectively, that consider cointegration dynamics.

During the third step, we analyze the causal connection between the variables by combining the vector autoregression (VAR) and the vector error correction model (VECM) analytical approaches, which treat all variables in the system as endogenous. Incorporating error correction terms, the extended form of the Granger causality specification is subsequently integrated into a bivariate error correction vector model (Engle and Granger, 1987). The following Equations (16)–(19) may summarize the formulation:

$$\Delta \mathrm{EMP}_t = \alpha_0 + \sum_{j=1}^{n} \beta_1 \Delta \mathrm{EMP}_{t-1} \sum_{j=1}^{n} \beta_2 \Delta \mathrm{GDP}_{t-1} + \sum_{j=1}^{n} \beta_3 \Delta D\mathrm{EBT}_{t-1} + \sum_{j=1}^{n} \beta_4 \Delta \mathrm{REER}_{t-1} + \gamma_{t-1} + \varepsilon_{1t} \tag{16}$$

$$\Delta \mathrm{GDP}_t = \alpha_0 + \sum_{j=1}^{n} \beta_1 \Delta \mathrm{GDP}_{t-1} \sum_{j=1}^{n} \beta_2 \Delta \mathrm{EMP}_{t-1} + \sum_{j=1}^{n} \beta_3 \Delta \mathrm{DEBT}_{t-1} + \sum_{j=1}^{n} \beta_4 \Delta \mathrm{REER}_{t-1} + \gamma_{t-1} + \varepsilon_{2t} \tag{17}$$

$$\Delta \mathrm{DEBT}_t = \alpha_0 + \sum_{j=1}^{n} \beta_1 \Delta \mathrm{DEBT}_{t-1} \sum_{j=1}^{n} \beta_2 \Delta \mathrm{EMP}_{t-1} + \sum_{j=1}^{n} \beta_3 \Delta \mathrm{GDP}_{t-1} + \sum_{j=1}^{n} \beta_4 \Delta \mathrm{REER}_{t-1} + \gamma_{t-1} + \varepsilon_{3t} \tag{18}$$

$$\Delta \mathrm{REER}_t = \alpha_0 + \sum_{j=1}^{n} \beta_1 \Delta \mathrm{REER}_{t-1} \sum_{j=1}^{n} \beta_2 \Delta \mathrm{EMP}_{t-1} + \sum_{j=1}^{n} \beta_3 \Delta \mathrm{GDP}_{t-1} + \sum_{j=1}^{n} \beta_4 \Delta D\mathrm{EBT}_{t-1} + \gamma_{t-1} + \varepsilon_{4t} \tag{19}$$

where:

Let ΔEMP_t denote the natural logarithm of labor demand, which is measured by the rate of labor force participation. The symbol ΔGDP_t denotes the natural logarithm of Gross Domestic Product (GDP), giving a measure of the total real domestic output in Indonesia for a given measurement period. The natural logarithm of the Real Effective Exchange Rate (REER) and the natural logarithm of the government foreign debt (measured in USD) are represented as $\Delta DEBT_t$ and $\Delta REER_t$, respectively, in international trade. The variable t denotes the year of observation. We shall denote α_0 as the constant coefficient and β $(\beta_1; \beta_2; \beta_3; \beta_4)$ as the coefficients of each estimated variable. Let $(\varepsilon_1; \varepsilon_2; \varepsilon_3; \varepsilon_4)$ be the error term.

4. Results and discussion

4.1. Unit root test

Before using the VAR model, it is necessary to perform the stationarity test at either the rate level or the differential level to determine the stationarity of the data. A unit root test is conducted using the Augmented Dickey-Fuller test, resulting in the subsequent findings：

As per **Table 1**, all variables demonstrate probability values that are less than 0.05 while being differentiated at the first degree. Therefore, the estimation in this research model can be carried out by using lag selection criteria and undertaking cointegration estimation to establish the long-term equilibrium relationship.

Table 1. Data Stationarity test results using ADF for variables in VAR Model.

Variables	Time Series	ADF Probability	Stationary (5%)
EMP	Level	0.3390	Non-Stationary
	1^{st}difference	0.0001	Stationary
GDP	Level	0.9795	Non-Stationary
	1^{st} difference	0.0033	Stationary
DEBT	Level	0.9260	Non-Stationary
	1^{st} difference	0.0177	Stationary
REER	Level	0.1127	Non-Stationary

4.2. Cointegration test

After verifying the stationarity (lack of a single root) of the variables in the data, it is crucial to establish a long-term relationship between them. This paper analyses this relationship by employing the Fisher-Johansen-based cointegration test.

Based on the information in **Table 2**, at least two cointegration equation models exist that exhibit a Trace Statistic value beyond the Critical Value and a Probability below the conventional significance level of 0.05. Therefore, cointegration among variables indicates a persistent and reliable relationship between them. The appropriate Vector Autoregressive (VAR) model for this work is the Vector Error Correction Model (VECM).

Table 2. Results of the Fisher-Johansen cointegration test: Exploring eigenvalues and trace statistics.

Number of Cointegrating Equations	Eigenvalue	Trace Statistic	Critical Value (0.05)	Prob.
None	0.8180	88.5894	47.8561	0.0000
at most 1	0.6984	44.2933	29.7971	0.0006
at most 2	0.3922	13.1324	15.4947	0.1100
at most 3	0.0072	0.1869	3.8415	0.6655

4.3. Granger causality results

The fundamental objective of the Granger causality test is to establish the cause-and-effect relationship between variables. Nevertheless, it can also examine the sequence in which variables are presented. Using the Wald Test of VAR Granger Causality/Exogeneity Block, we investigated the causal relationship between the variables in our study. The empirical results are presented in **Table 3** below.

Table 3. Results of the granger causality test: Analyzing causal relationships among variables.

Hypothesis	Chi-sq	Prob.	Type of causality
GDP does not Granger cause EMP	3.459357	0.1773	No causality
EMP does not Granger cause GDP	0.803312	0.6692	No causality
DEBT does not Granger cause EMP	10.41442	0.0055	DEBT EMP
EMP does not Granger cause DEBT	2.945144	0.2293	No causality
REER does not Granger cause EMP	1.359128	0.5068	No causality
EMP does not Granger cause REER	0.656326	0.7202	No causality
DEBT does not Granger cause GDP	3.415155	0.1813	No causality
GDP does not Granger cause DEBT	2.246231	0.3253	No causality
REER does not Granger cause GDP	0.849865	0.6538	No causality
GDP does not Granger cause REER	9.826217	0.0073	GDP REER
REER does not Granger cause DEBT	0.237938	0.8878	No causality
DEBT does not Granger cause REER	1.979591	0.3717	No causality

As shown in **Table 3**, the outcomes of the Pair-Wise Granger Causality Coefficients for the specified variables in the model are shown. This test uses the f statistic and its associated probability value. The causality test results indicate that all the variables are not mutually related. On the other hand, causality was estimated from either foreign debt affecting labour demand or the GDP impacting the Real Effect Equivalent Exchange Rate. Looking at **Table 3**, it is evident that there are few causal effect links between the variables in the model. A bi-directional causality between log GDP and log EMP does not hold, meaning either variable leads to a change in the other.

On the contrary, external debt (DEBT) Type two Granger causes employment; this shows that increasing government debt affects the employment level through labour demand. The causality of other variables with employment has not gone full circle with the debt factor. Furthermore, the Folland econometric approach shows that GDP Granger causes REER and that, conversely, the exchange rate does not cause

GDP besides affecting it once changes have occurred. Altogether, these outcomes demonstrate directional causality between external debt and employment, and GDP influences the exchange rate, but the rest of the variables do not have any causal relationship.

4.4. Vector Error Correction Model (VECM) estimation results

Table 4 displays the long-term and short-term correlations between employment, GDP, external debt, and Real Effective Exchange Rate for the two cointegrating coefficients in Indonesia from 1991 to 2022. In the short run, government external debt, resulting from fiscal deficits, will positively impact economic growth through public investment, which may often lead to a rise in demand for labour. However, as the short-run coefficients and t statistics show, this stimulus may be countered by growth in financial risks, such as a negative relation between debt and REER, implying possible currency devaluation. This depreciation reduces the workers' purchasing power, increases the attractiveness of overseas employment opportunities and declines the domestic absorption of labour. Long-Term Impact: In the long run, the signs associated with the dependent variable DEBT point to government external debt reducing labour demand. This could be due to the social cost of sustained debt to industrial development. Lifting of debt elevates financial uncertainties, reduces investment and limits industrial advancement, all factors pushing down labour demand. In addition, a longer-term loss of currency value erodes the efficiency of industries that depend on imports for production and that can diminish the demand for labour.

Table 4. Estimation of Vector Error Correction Model (VECM).

Variables	Coefficient	Standard Error	*t*-statistic
Long-Run Relations			
GDP	1.96291	0.3314	5.9231
DEBT	−1.67265	0.2699	−6.1972
REER	0.82007	0.1794	4.5698
C	−15.2901		
Short-Run Relations			
ECM			
D (EMPLOYMENT)	0.070544	0.01938	3.64039
D (GDP)	−0.09177	0.08444	−1.08673
D (DEBT)	0.175421	0.11581	1.51473
D (REER)	−0.85834	0.27004	−3.17859
D (EMPLOYMENT (−1))	−0.68349	0.25884	−2.64056
D (EMPLOYMENT (−2))	−0.30275	0.20981	−1.44297
D (GDP (−1))	−0.06476	0.11513	−0.56244
D (GDP (−2))	−0.21041	0.12391	−1.69809
D (DEBT (−1))	0.080518	0.03838	2.09803
D (DEBT (−2))	0.096825	0.04493	2.15526
D (REER (−1))	−0.03059	0.02985	−1.02491

Table 4. (*Continued*).

Variables	Coefficient	Standard Error	*t*-statistic
D (REER (−2))	−0.01404	0.0212	−0.66253
C	0.001486	0.00706	0.21063
Model Fit			
R-squared (EMPLOYMENT)	0.702827	F-statistic	4.204517
Adj. R-squared (EMPLOYMENT)	0.535667	S.E. equation	0.008901

Type: Standard errors in () & t-statistics in []. Source: data processed in reviews, 10.0.

Furthermore, all coefficients exhibit statistical significance at the 5% critical level in the long term. According to Søren's (2005) findings, the coefficients of a cointegrating vector can be interpreted as long-term elasticities when the variables are represented in logarithmic form. Furthermore, with time, every 1% increase in GDP will lead to a 1.962% increase in labour demand. Each incremental increase of 1 per cent in external debt will lead to a 1672 per cent decrease in labour demand over time. Nevertheless, there is a clear difference in the general understanding of the long-term relationship between the effective exchange rate and labour demand. More precisely, a one per cent increase in the real effective exchange rate is projected to lead to a long-term increase of 0.820 per cent in labour demand.

The Vector Error Correction Model (VECM) can calculate long-term and time-dependent dynamics. In the estimated system, the error correction term accurately reflects the behavior of a variable when there is no equilibrium present. Observations within the estimated system indicate a decrease in GDP and real effective exchange rate in cases of imbalance, but labour demand and debt tend to increase. The error correction factors associated with labour absorption, GDP, foreign debt, and real effective exchange rate are estimated to be 0.0705, −0.0917, 0.175, and −0.858336, respectively.

The short-term estimate is based on the Error Correction Model (ECM), which examines the influence of GDP, foreign debt, and real effective exchange rate on labour demand. Research findings indicate a significant inverse relationship between labour demand and itself at lag 1. Each unit increase of 1 per cent in employment in the previous year will result in a proportional decrease of 0.683 jobs in the following year. Moreover, a significant short-term relationship is marked by a positive connection between foreign debt and labour absorption at both the first- and second-time lags.

Each 1 per cent increase in foreign debt in the previous year will result in a proportional rise of 0.081 in labour absorption in the following year. An upward movement of 1 per cent in foreign debt during the previous two years will lead to a 0.096 increase in employment in the following two years.

4.5. Responses of labour demand, GDP, foreign debt, and REER to shocks in labour demand

Table 3 also shows the Coefficient of Determination (R^2) of 0.7028 which can be interpreted that GDP, foreign debt, Real Effective Exchange Rate can explain the demand for labour by 70.37 percent. **Figure 3** illustrates that all the impulse responses

labelled in **Figure 3** capture the impulse response of labour demand to shocks and GDP, external debt and REER. Labour demand has a positive coefficient for its shock, which suggests that it is persistent through time. The job creation shocks are positive and sizable and increase steadily with a positive shock to GDP, thus indicating that growth boosts employment. In the same way, as in the case of foreign reserves, external debt also positively influences labour demand, but this influence increases with time, indicating that government spending or investment financed through borrowed funds generates longer-term effects. Whereas change in REER displays a less vigorous and less variable correlation with employment, this provides evidence that fluctuations in exchange rates do not necessarily affect employment in the same way and the identical stead as foreign trade depends upon. However, from the analysis, the two strongest determinants of labour demand seem to be GDP and external debt, and REER has a lesser influence.

Figure 3. Labour demand responds to shocks in GDP, foreign Debt, and REER.

Figure 4 indicates that higher GDP shock results in a continually rising foreign debt authority due to increased borrowing for the economy's growth. The initial impact of labour demand shock is a tiny decline in debt and a minor increase after the short run. Debt increases positively to its shock, indicating that borrowing trends will persist. Lastly, the response of foreign debt is almost zero, indicating that REER shocks do not affect foreign debt so much.

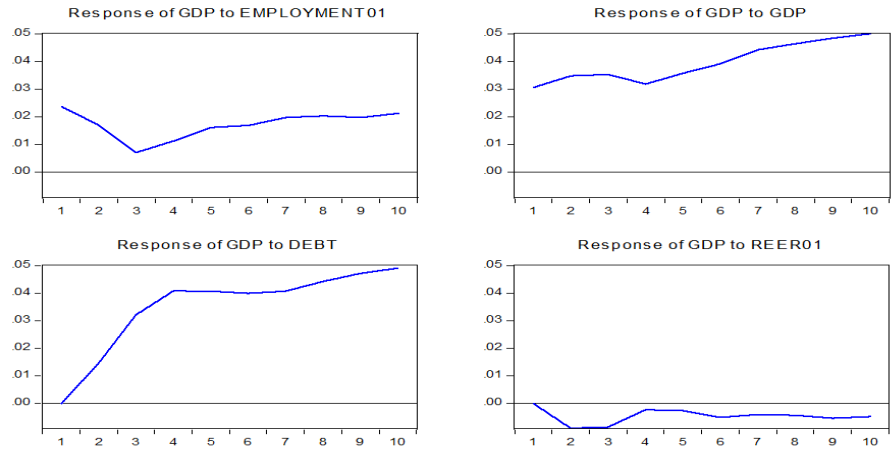

Figure 4. The impact of GDP shocks on labour demand, foreign debt, and REER.

Figure 5 represents the response of GDP to shocks in EMPLOYMENT01, GDP, DEBT and REER01. An increase in external debt at the beginning causes an increase in the GDP, which later becomes constant, expressing that external borrowings propel economic growth for some time. Analysis of GDP on the response to labour demand shocks reveals a steep initial drop and then a sustained upward trend, implying that employment shocks take time to affect GDP positively. In response to its shocks, GDP continues to exhibit stable responses, thus remaining persistent in its growth paths. However, the effect of REER on GDP is minimal and close to zero, which depicts that the bi-variate response of GDP is non-sensitive to the exchange rate. External debt appears to be a decisive pull factor in short-term GDP growth.

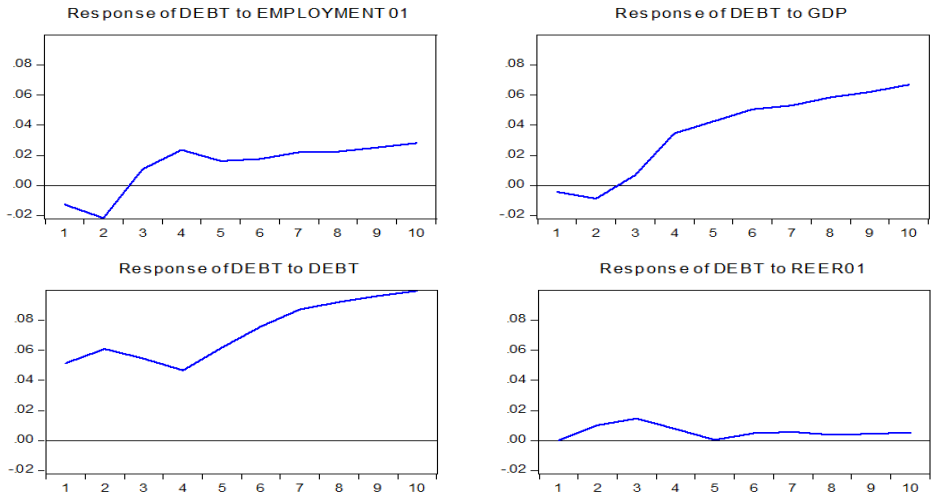

Figure 5. The effects of external debt shocks on labour demand, GDP, and REER.

Figure 6 represents the reaction of the Real Effective Exchange Rate (REER) to the shocks in labour demand (EMPLOYMENT01), GDP, external debt (DEBT) and REER. The response of REER to labour demand initially positively sloped, rising and falling over time; hence, labour demand shocks only have a short-term impact on the exchange rate. Concerning how REER reacts to GDP shocks, fluctuations are also relatively high, but signs remain primarily positive, which indicates that the exchange rate is affected by GDP growth rates. The response to external debt shocks, of course,

is less so but is significantly positive and more stable, which means that an increase in external debt will lead to the sustained depreciation of any world currency. Finally, the response of REER to its shocks can be considered volatile but decaying; its volatility does not remain constant over time but increases and decreases over time. This figure implies that while labour demand and GDP exert short-run effects on rent, external debt exerts more substantial and long-run effects on the exchange rate; hence, the economy, the demand for labour, is not left out.

Figure 6. How REER responds to shocks in labour demand, GDP, and external debt.

The orthogonalized impulse response function (OIRF) is a statistical method employed to examine the dynamic effects of shocks that transition between variables in a structure. This study aims to analyze the impact of debt and currency rate shocks on labour demand. A graphical representation of the OIRF shows the time-dependent response of the variables in the system to a shock of one standard deviation—the effects of foreign debt shocks on Economic Growth, Employment, and Real Effective Exchange Rate. The first debt shock has a negative effect on labour demand until the second year, gradually shifting to a consistently positive effect on labour in the third year. External shocks to foreign debt led to the strengthening of the Indonesian currency, the rupiah. Nevertheless, the effect is temporary until the third year and diminishes until the fifth year. Therefore, the effect stabilizes in the sixth year. The diagram demonstrates that a debt shock results in a decline in GDP until the second year, establishing a consistent positive effect in the third year.

The response of labour demand to the shock in the Real Effective Exchange Rate is depicted in **Figure 6**. The response exhibited is variable. A negative association is shown in the direct response to the third period. Subsequently, it manifests a favorable pattern until the fourth year, returning to an unfavorable pattern in the fifth and sixth years. Empirical data suggests that the response of employment to fluctuations in the Real Effective Exchange Rate is consistently adverse and persists beyond the 20th year.

Figure 4 depicts labour demand's response to GDP surprises. The response initially demonstrates a detrimental effect until the third period; thereafter, it undergoes a continuous beneficial transformation from the fourth year.

This indicates that a decline in GDP directly and negatively affects labour demand, resulting in a rise in the unemployment rate. Nevertheless, the impact is resolved only after the fourth year.

5. Discussion

This study employs the exchange rate pass-through transmission approach to examine foreign debt's collective long-term and short-term impacts on labour absorption. An increase in foreign debt significantly impacts the demand for work. Empirical data from history has shown that an increase in foreign debt has an adverse effect on long-term labour demand. Bertola (2010) contends that as debt rises, the quality of available employment decreases, especially when debt requires higher labour taxes. Furthermore, a rise in external debt might result in a higher debt servicing burden on the national Government. The statistical assessments by Mayer and Steingress (2020) and Reinhart et al. (2012) provide evidence that government activities resulting in fiscal deficits are strongly associated with increased inefficiency, ultimately leading to decreased economic growth. Moreover, Reinhart et al. (2012) provide evidence that an ineffective government fiscal policy will impact the decision-making process of private economic operators, in turn making private activity inefficient.

Furthermore, the negative impact on job demand becomes evident in the third year of the external debt shock, which is then succeeded by decreased economic output. During times of heightened economic uncertainty and the potential for increased financial risk due to burdensome external debt, firms may opt to curtail or even reduce their workforce. The results of this study align with the conclusions of Tavares (2019), indicating that a series of economic shocks will increase the vulnerability to debt and reduce the demand for labour by firms, therefore leading to instability in the labour market. Hence, it increased the probability of joblessness and produced labour inefficiency (ineffective wage inequality).

Budgetary instruments are used to exacerbate the budget deficit in order to impact employment and unemployment indicators. Conversely, reducing debt consumption can result in a decline in employment. Bertola (2010) argues that the increasing public debt of industrialized countries in the latter half of the 20th century can be ascribed to interventions enacted in response to the decline in workforce productivity. In the near term, the present study investigates the correlation between public debt dynamics and employment growth. Elevated levels of existing debt can enhance economic activity by increasing the buildup of capital stock. A study by Menguy (2019) indicates that increasing government debt may have favourable impacts on immediate economic activity, such as the labour market. However, it can have adverse repercussions in the long run.

Policies enacted in reaction to crises inevitably give rise to persistent problems in the future. Ordinarily, the fiscal and monetary measures used in reaction to crises lead to a long-lasting effect of substantial public debt and intimidating inflation forecasts for future administrations. The challenge of effectively managing this emergency legacy without disturbing labour market performance is formidable following the crisis. Economic measures implemented during crises can have complex

and unpredictable long-term impacts on the labour market. Therefore, policymakers must carefully assess the long-lasting effects of the fiscal and monetary policies they adopt in response to the crisis.

The workforce's response to currency volatility usually shows a downward trajectory until it maintains a steady level in the 20th year. An appreciation in the real effective exchange rate will substantially strain improved efficiency in labour use. Hence, this will have a negative impact on the degree of capital intensity and hinder the magnitude of exports (Hua, 2007). A contrasting analysis showed that the appreciation of the real effective exchange rate has a positive long-term effect on the demand for labour. Although there may be an initial decline in employment as the currency value increases, this strengthening currency can affect the overall economic framework in the long run. Sustained economic growth can create new job opportunities in sectors that respond to changes in currency values. Furthermore, strengthening the currency exchange rate, which increases the buying power of the local economy, can also encourage investment and consumption growth, increasing labour demand.

6. Conclusion and recommendations

In the short run, an enhancement in government foreign debt may enhance demand for labour through access to capital and extension of fiscal incentives. This is evidenced by the first stream in the figure above, which shows the initial increase in the labour force participation rate when the debt-to-GDP ratio increases, especially during the stimulus after the crises. However, in the long run, this increases the Government's stocks of outstanding debts, and servicing these debts puts a very high burden on the economy since it limits efficient government spending on unnecessary government programs and decreases the ability to invest in productive activities. In the long run, it reduces demand for labour, which is seen by the decline in the labour force participation rate during the steady rise in debt level, as illustrated by **Figure 1**. An initial favourable effect of the genuine adequate exchange rate appreciation is improved wage cost efficiency and labour demand. However, high debt levels reverse these gains in the long run. As evidenced after the year 2020, when the rate of external debt tends to rise, followed by economic instability, it causes fluctuations in labour force participation, indicating that high and rising levels of debt hamper the stability of the labour market. Hence, it can be inferred that, though foreign debt has a particularly positive impact in the short run on the economics of a country, healthy management of foreign debt is essential to avoid any adverse consequences on labour market employment.

6.1. Study limitations

However, it is essential to recognize some limitations in this research on the effects of foreign debt on labour demand through the exchange rate pass-through channel. First, the study was conducted solely among Indonesian respondents, and, therefore, the results cannot be generalized to any other emerging markets. The Indonesian economy, its financial policies, and the employment market may not be similar to other countries' economies; thus, the results may not be the same if carried

out in the same manner. Secondly, it is based on past data, meaning it does not account for future changes in economic conditions or the changing dynamics of the international financial system, especially after the COVID-19 shock. Thus, many aspects of the pandemic's current and possible further developments may not reflect other future crises or long-term economic tendencies concerning foreign debt and labour markets. Furthermore, the analytic model employed in the research is susceptible to time series data, which can present an accurate picture only if free from reporting discrepancies or subsequent revisions. This can bring biases into the results, especially when estimating macroeconomic variables such as external debt, demand for labour and exchange rates. Also, the study mainly uses macro-level indicators of labour demand, excluding the differentiation between sectors or types of employment, which might allow us to learn more about how foreign debt impacts different parts of the labour market. Finally, the study suggests that our model's short-term and long-term effects have not considered nonlinearity or structural breaks and may distort those results.

6.2. Recommendations for future research

Further research should consider extending the investigation coverage to other emerging markets to draw a comparison. This would give a broader perspective on the effect of foreign debt and exchange rate changes on labour demands to generalize across the different systems. Future analyses will unveil either certain relative factors certain to particular countries or specific broad trends applicable universally while comparing more than one country with different fiscal policies, labour market structures, standard comparative figures, and different levels of external debt. Also, it would be valuable for future research to employ sectoral approaches to address how foreign debt affects the demand for labour in sectors. It would provide a subsector-level insight into how sectors like manufacturing, agriculture, and services are more or less sensitive to the shocks of external debt and foreign exchange fluctuations. Two other areas for future research include using nonlinear models or structural breaks to determine whether different thresholds or values of the debt or economic shocks (such as financial crises) have different long-run and short-run effects on labour demand.

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