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The Impact of Minimum Wage on Average Earnings in the Caribbean using Two-Selected Countries, Trinidad and Tobago and Jamaica (1980-2011 and 1997-2011)

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...it is no kindness to the workers in a trade to merely turn them out (H.B. Lees Smith: 560)

Abstract

This paper examines the impact of minimum wages on average wage earnings in two selected countries, Trinidad and Tobago and Jamaica using a time-series data for the latter and a panel data for both. The methodology of GMM time-series estimation is used on the Jamaican data (1980-2011) and a Two Stage Least Square Regression model is used for the panel data (1997-2011). The impacts of minimum wage on average earnings are mixed. In the time-series model, the real minimum wage has a negative and significant impact on the real average earnings, a unit change in the minimum wage decreases earnings by \$2. However, in the panel model, the minimum wage positively impacts the real average wage by the same amount. Thus, the minimum wage alone cannot be used to boost average earnings; emphasis needs to be placed on the productivity of workers and the cost of doing business in the Caribbean.

JEL codes: B23, C23, C26, E24

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1. Introduction

The debate on the minimum wage policy especially as it relates to its employment/disemployment effects started in early 1980s with the seminal work of Brown, Gilroy and Kowen (1982) who asserted that the labour market at that time was competitive and these authors did think it was not logical for firms to pay their workers more when the minimum wage rose since such a hike in the minimum wage would act as a disincentive for the employers of labour. The relationship between minimum wage and average earnings has been hotly debated by labour economists. Especially, since the empirical works of Card and Krueger (1994), Katz and Krueger (1992), Hamermesh (2000), Neumark and Wascher (2006), Downes (2000), Addison et al (2008), these economists have all contributed immensely to the debate of how an effective minimum wage could be designed. More importantly, these erudite scholars critically examine the disemployment effects minimum wage has on the economy. An important aspect of the minimum wage research is its applications in sociological research, for example, Hamermesh found out that beauty has a statistically significant impact on the wage that females are paid.

Moreover, researches that deal with minimum wage policy have been restricted to county-level, state-level, firm-level panel data analyses using mostly fixed and random effects estimation techniques. There is a dearth of research in country-wide panel data estimations and greater emphasis has been placed on the theoretical construct of the minimum wage. Few economists have actually made use of other estimation techniques to empirically test the relationship between average earnings and minimum wage.

This study has been deemed necessary as an attempt to bridge the gap that has been left open by labour economists in the Caribbean because it attempts to investigate the endogeneity

bias minimum wage has on real average earnings and seeks avenues through the use of GMM and TSLS to overcome such a problem. First, all the variables are deflated with the consumer price index to express them in real terms and to be able to analyze the real impact of minimum wage, conditioned on the its lags, the lags of other independent variables, some interaction terms and square terms, on average earnings. The results derived when this is done are mixed, in the GMM time-series model, the minimum wage positively impacts the average earnings and in the two- stage least squares model, average earnings fall when the minimum wage changes. This indicates that a policy instrument such as minimum wage cannot be used at this time to reduce poverty, unemployment or boost income. Greater emphasis has to be placed by the Government of Jamaica on reducing the debt-to-GDP ratio, improving productivity and inducing workers to choose appropriate levels of effort.

However, it could be said that if both Jamaica and Trinidad & Tobago pool resources together, the minimum wage along with other welfare-improving policies, should be used to raise real average earnings in both countries, but the possibility of such cooperation is limited at this time. The government of the twin-islands of Trinidad and Tobago may not accept to pay down some of the debt owed by the Jamaican government consequently a possibility of debt reduction arrangements between both countries is not feasible.

The study is divided into five sections, section one deals with the introduction of the study, section 2 reviews relevant literature, section 3 looks at the model specification and data sources, section 4 attempts to empirically test the model and offer economic explanations for the results. Section 5 concludes the paper and makes stylized recommendations. An appendix is included at the end of the paper where the estimation methods are discussed; also, kernel density graphs, descriptive statistics and correlation matrices are added.

Section 2: Literature Review and Theoretical Framework

The literature on the impact of minimum wage went as far back as the 1980s when there was just an orthodox view about the correlation between minimum wage and earnings. Most of the studies agreed that there was indeed a disemployment effect brought about by increases in the minimum wage. Most of the analyses were done for counties in the U.S., manufacturing sub-sectors such as the beer industry, retail sectors, and some target groups who were directly affected by minimum wage policies for example youths, production workers and shop assistants. Brown, Gilroy and Kohen (1982) found that there was a modest but statistically significant negative effect of minimum wage on employment using a time-series data to test the impact of minimum wage on youth employment and unemployment (Edagbami, 2006). Panel studies that were done in the 1990s to the 2000s challenged some of the findings especially as it relates to the impact minimum wage has on unemployment although there has not been a consensus on the employment/disemployment effects of minimum wages.

Overall, there have been mixed results in the literature on minimum wages, employment and earnings. Addison, Blackburn and Cotti (2008) find little evidence of disemployment effects in the United States, rather they admit that their results suggest positive employment effects of minimum wage, the fixed effect estimation framework these authors use shows that a 10% increase in the minimum wage is estimated to generate 1-2% increase in employment in the sectors considered. Oswald and Blanchflower (2006) are the first to empirically prove that the wage curve elasticity (logarithm of unemployment with respect to the logarithm of the average earnings) of -0.1 applies to counties in the US and European Union member countries, more importantly, they allude to the fact that non-competitive theories of labour market validate the negative relationship between unemployment and average earnings. They use a simple analogy:

“if unemployment is high and firms decide not to increase the wages of their workers, workers would not give up their jobs because they know jobs do not exist elsewhere, therefore these workers have to settle for low wages”. Neumark and Wascher (2006) review several studies on the link between minimum wages, earnings and employment and report that in spite of the fact that the orthodox theory of minimum wage has not been in tandem with current findings, there is still no consensus concerning the wage-employment nexus.

Downes (2000) specifies a dynamic labour demand function which takes into consideration regulations in the labour market, labour cost (wage) and other non-regulatory measures for Jamaica, Trinidad and Tobago and Barbados, he asserts using co-integration and error-correction modelling that all the variables have long run relationships.

Hamermesh and Biddle (1993) add a new twist to the minimum wage literature by empirically testing the correlation of beauty with the rate of pay, the authors assert that better looking people are more likely to sort into occupations where beauty is likely to be more productive. They find that 9% of working men in the United States who are viewed as being below average in terms of looks are penalized about 10% in hourly earnings, 32% of men who are viewed as above average in looks receive earnings premium of 5%. For women, the penalty for bad looks (among the lowest 8% of working women) is 5%. Overall, there is 7 to 10% penalty for being in the lowest 10% in terms of looks among all workers and 5% premium for being in the top 30%.

Aaronson, D., et al (2009) affirm that following a minimum wage hike, households buy vehicles. However, vehicle purchases increase faster than income among impacted households. The size, timing, distribution and composition of spending response are not in tandem with

certainty equivalent life cycle model. The response is however consistent with a model in which households face collateral constraints. Spending response is too large to be consistent with the permanent income hypothesis. Moreover, the authors confirm that a \$1 increase in the minimum wage raises spending by over \$800 in the near term, this exceeds roughly \$300 per quarter increase in family income following a minimum wage increase of similar size. All told, minimum wage hikes increase lifetime income by roughly \$1500. If households were spreading that income gain over their lifetimes, the short-run spending increase should be an order of magnitude smaller than what is actually observed.

Moreover, Aaronson, et al (2009) further state that so long as minimum wage hikes are known in advance, the permanent income hypothesis implies that minimum wage earning households should increase spending before the hike. However, if households are unable to borrow against future income in order to finance current spending, spending will not rise until the minimum wage increases. The authors find that the minimum wage has small effects on income and spending of workers making 120 to 200% of the minimum wage and no effect on workers who are earning at least double of the minimum wage. In their closing remarks, the authors ascertain that minimum wage increases only have large effects on the incomes of minimum wage workers, at least in the short-run

Cotti and Tefft (2012), employing a two stage least squares regression function, use the minimum wage to control for the effects of rising food prices in the US on obesity and they find that fast food price changes do not necessarily affect BMI (Body Mass Index) or obesity prevalence. Aaronson (2001) is quoted by the authors, he demonstrates that there may be lagged effects of minimum wage changes on fast food prices in accordance with theories which state

that firm output prices may not instantaneously respond to input costs. This justifies the inclusion of lagged and contemporaneous minimum wage.

Maloney and Mendez (2003) purport that the minimum wage impacts beyond those contemplated in the advanced countries. The authors agree with Neumark (2001) who empirically shows that earned incomes of low-wage workers decrease and poverty actually increases when there is a hike in the minimum wage. Kernel estimators are used by these authors to investigate the nature of wage distribution functions for Brazil, Chile and some other Latin American countries.

Porter and Vitek (2003) assert that the increase in the minimum wage affecting only 20% of employees would amplify output volatility by 0.2% to 9.2% and employment volatility by -1.2% to 7.8%. A fixed wage or indexation to unit labour cost or wage inflation is preferable, largely protecting the flexibility of the labour market. A Dynamic Stochastic General Equilibrium model² is employed by the authors which depicts that government needs to balance the design of a minimum wage policy with several other factors such as inflation, competitiveness, business operations and employment. Hong Kong SAR is considerably exposed to shocks transmitted via trade and financial channels and for the economy to be flexible enough; asset prices and the product market must not be perturbed. The same thing could be said of Trinidad and Tobago and Jamaica, because these are small-island economies that have large exposures to external shocks.

² The DSGE model features short-run nominal price and wage rigidities generated by monopolistic competition, staggered re-optimization, and partial indexation in the output and labour markets. Staggered wage setting is applicable to high-skilled individuals who have monopoly power in the labour market while those with low skills are subject to the minimum wage.

The main argument in Porter and Vitek's article is that the minimum wage should be introduced in a way that aids domestic price flexibility. Skilled individuals participate in flexible labour market, unskilled persons are paid a binding legislated minimum wage thus they essentially do not have much bargaining power. The skilled persons can often optimize the wages they are paid regularly to reflect their marginal product. There are five types of minimum indexation considered by the authors, these include: no indexation (fixed minimum wage), indexation to aggregate wage inflation, indexation to unit labour cost, indexation to consumer price inflation and average labour productivity growth.

Moreover, Porter and Vitek (2003) further assert that inequality needs to be considered in improving the efficacy of the minimum wage. "A minimum wage does not with certainty mean inequality will fall, it might remain high". This is evident in Hong Kong SAR and similar sentiments could be expressed for countries like Jamaica and T&T. Income distribution in Hong Kong is bimodal reflecting apparent segmentation in the country between skilled and unskilled labour. Also, T&T and Jamaica have bimodal income distribution curves as well (Kernel density curves in the appendix). Introducing a minimum wage without indexing it is estimated to inflate business cycle volatility by 9.2% at 20% coverage level and employment by 6.6%. However, indexation of the minimum wage to aggregate wage inflation restores output and labour market efficiency more rapidly in response to shocks than alternative mechanisms. The authors, in their concluding remarks, note that by lessening income inequality, introducing a minimum wage may be expected to promote social stability. However, by reducing labour market flexibility, it also has the potential to elevate macroeconomic volatility and distort dynamic response of the economy to shocks. Choosing the minimum wage is a social choice and must be supplemented with welfare payments to provide poor families with additional support.

Based on analysis of micro-founded employment functions in contrast to predictions of the textbook analysis; Ragacs (2003) shows in his article that no significant negative effect of minimum wages on employment is found. Focusing on human capital formation, minimum wages could internalize parts of the external effects yielding increased skills accumulation inducing higher economic growth, and in some models, even increased employment. The author makes use of co-integration analysis. High correlation is found between minimum wage and average wages.

Wallis (2002) uses a simultaneous equation model and Zellner's seemingly unrelated equations approach to investigate the impact of skill shortages on real wage growth and unemployment. It is confirmed that skill shortages have a significant positive effect on the real wage growth and a negative effect on unemployment.

Wilson (2012) empirically shows that minimum wage policies stifle job opportunities for low-skilled workers, youths and minorities which are groups policymakers often try to help with these policies. If government requires that certain workers be paid higher wages, then businesses make adjustments for the added costs, such as reducing hiring, cutting employee work hours, reducing benefits and charging higher prices. The author further asserts that many minimum wage workers live in families with incomes above the poverty level and there are some working poor persons who actually earn above the minimum wage, thus targeting poor persons with a minimum wage policy must be done with care.

In addition, Wallis puts forward three theories that have, over the years, explored the effects of minimum wages, these include: monopsony, competitive and institutional. In summary, the competitive theory of minimum wage asserts that a higher minimum wage draws

high-skilled workers into the market with the prospect of earning such a wage, this leads to a decrease in the employment which consequently shuts out the lower-skilled persons. In the monopsony model, there are few big firms who have monopoly power thus they face an upward sloping supply curve of labour, such firms have the right discretion in setting wages. Also, the institutional model looks at the costs of minimum wage increases which are generally offset by reducing organizational slack and increasing productivity, costs that cannot be absorbed by firms are passed on to customers through high prices.

Zavodny (1998) asserts that several time series studies of the minimum wage effects on teen employment rates do not find that higher wages are associated with significantly lower employment rates (Neumark and Wascher, 2006; Card, Katz and Krueger, 1994, Wellington, 1991). However, Brown, Gilroy and Cohen (1982) confirm that teen employment rates fell at least by 1% when the minimum wage rises by 10%. More so, Card and Krueger (1995) further validate the result of the latter (Brown, Gilroy and Kohen's results) by suggesting that methodological problems biased the results in earlier studies. Zavodny further corroborates his argument by stressing that when employment falls, GDP falls and prices rise and if the demand curve for labour is inelastic, price increases offset the fall in employment as a result of wage increase.

Acemoglu (1996) asserts, using a search-theoretic modelling framework, that the composition of jobs improve considerably in response to higher minimum wages and generous unemployment benefits consequently improving welfare. He however points out that the composition of jobs is always suboptimal and that there are too many low wage/bad jobs. Different types of jobs have different capital costs and those which cost more will have to pay higher wages due to rent-sharing and therefore good and bad jobs always exist in the economy.

In an unregulated labour market, the composition of jobs is biased towards bad jobs. The reason for this inefficiency is that good jobs cost more to create but firms do not necessarily receive the full marginal product of their investments because with higher productivity, they have to pay higher wages.

Shapiro and Stiglitz (1984) argue that equilibrium unemployment could always be used as a device of ensuring that workers do not shirk while working. They argue that in the competitive paradigm, all workers are paid at the 'going wage' and if a worker shirks and is fired, he can easily be rehired by another firm and there is no penalty for his misdemeanour. However, if a firm raises wages above the 'going wage' and one of its workers shirks, such a worker faces a heavy penalty and he or she will therefore not shirk. Moreover, if a firm raises its wages, it will benefit other firms to do the same and the no-shirking incentive disappears again. Once all firms raise wages, the demand for labour falls and workers do not have an incentive to shirk because if they are caught shirking and fired, they cannot immediately find jobs elsewhere. Yellen (1984) does a critique of the literature of efficiency-wage models of unemployment and also looks at the micro-foundations of the efficiency wage model such as adverse selection and labour turnover. She asserts that if labour productivity depends on real wage then cutting wages may raise labour costs

Gindling and Terrell (2011) use individual-level panel data to study the impact of legal changes in minimum wage on a host of other labour market outcomes such as transitions into and out of poverty, wages and employment and transition of workers across jobs. These economists purport that changes in the minimum wage only affect those workers whose income level before the change is close to the minimum. Also, the estimates from the employment transition the two authors obtain show a decrease in covered private sector employment due to the combination of

layoffs and reductions in hiring. Moreover, these two authors admit increases in the legal minimum wage raise the probability that a poor worker's family move out of poverty if such increases impact the head of the household rather than the non-head.

Raff and Summers (1987) purported that an introduction of a \$5 day programme in 1914 by Henry Ford validated the efficiency wage theory and this substantially lowered absenteeism, turnover and increased productivity and consequently profits.

According to Bellante (1994), the concept of efficiency wage posits a positive relationship between wages and productivity over some range. Up to some point, raising wages might lower per unit cost. What inevitably motivates workers is the extent to which the wage at the firm in question exceeds wages obtainable elsewhere that is the market wage conditioned on the probability of obtaining it. If a firm faces a decrease in demand, it will not take advantage of the seeming opportunity to reduce the wage cost because lowering such cost will eventually raise its per unit cost. The level of unemployment is not even affected by the shape of the demand curve for labour- only the average wage level is affected by its shape.

Bellante (1994) further supports his argument by pointing out that real wages have actually doubled without consequential impact on average unemployment rates. The wage (w) to which workers compare their received wage is the wage rate elsewhere (also w) but discounted by the probability of receiving it $(1-u)$ where (u) is the unemployment rate. In this manner, the wage, w , can be uniform across firms and workers can still receive a premium that will induce them to avoid shirking and stay with the firm.

Ryska and Prusa (2012) believe that if the labour markets are modeled as fully heterogeneous, involuntary unemployment does not follow. The two authors believe that even

though the two-efficiency wage models, Solow's (1979) generic efficiency wage model and Shapiro-Stiglitz (1984) shirking model differ in the degree of wage rigidity, they both lead to involuntary unemployment. However, Ryska and Prusa empirically prove that there is no voluntary unemployment because of the following reasons: One, price per unit of effort (that is effort wage) at which workers can compete is a voluntary decision based on their preferences. Given that the effort function is fully determined by workers' preferences, there exists no room for voluntary unemployment. Equilibrium must be attained insofar as the neoclassical assumptions in the individual submarkets are met. This is not to say that frictions do not exist in these markets. It is merely to show that effort or quality variations of labour do not generate disequilibrium.

Carmichael (1985) affirms that workers who do not work at w^* can simply post a bond to pay for their jobs, this reduces their valuation of the job and so they are indifferent between working and being unemployed therefore unemployment is involuntary. Shapiro and Stiglitz (1985) provide an answer to Carmichael's question of the existence of involuntary unemployment. They argue that entry fees lead to a double moral hazard problem. Individuals will be concerned about putting money up front, less the firm take their money and either fire them or make their jobs so unpleasant to induce them to quit.

Meer and West (2012) assert that the effect of minimum wage should be more apparent in employment dynamics than levels. Minimum wage reduces gross hiring of new employees, but there is no effect on gross separations; increases in legal minimum wage reduce job growth.

Yellen (1984) reviews the dual labour markets theory of efficiency wage and shows that in the primary sector, the efficiency wage hypothesis holds, job rationing and voluntary payment

of workers by firms of wages in excess of market clearing are features of this sector. However, in the secondary sector, where the wage-productivity nexus is weak or non-existent, there should be observed a fairly neoclassical behaviour. The market in the secondary sector therefore clears and people can take up jobs easily albeit at a lower wage. The existence of the secondary sector does not, however, eliminate involuntary unemployment (Hall, 1975) because the wage differential between the primary and the secondary sector jobs will induce unemployment among job seekers who seek to wait for primary-sector job openings.

Hall (2003) develops a wage friction model (a friction can be interpreted in terms of wage norm that provides the equilibrium selection function) where he supports the sticky-wage model of fluctuations. The friction in his model arises in an economic equilibrium and satisfies the condition that no worker-employer pair has an unexploited opportunity for mutual improvement. Hall further states that the friction neither interferes with the efficient formation of job matches nor causes inefficient job losses. When the wage is relatively high – closer to the employer's maximum--- the employer anticipates loss of surplus from new matches and puts correspondingly less effort into recruiting workers. Jobs become hard to find, unemployment rises and employment falls. The friction is plausible because it occurs only within the range where the wage does not block efficient bargain from being struck and maintained. The outcome of the bargain between worker and employer is fundamentally indeterminate and the wage friction is an equilibrium selection mechanism.

Zenou and Jellal (1999) introduce the quality of job matching into the effort function in order to calculate the efficiency wage. There are two cases that allow the evaluation of the impact of job matching on the effort function to be done. In the first case, the authors consider a condition where the quality of the match is perfectly observable by the firm and it is shown that

the equilibrium unemployment level is due to both high wages and mismatch. In the second case, job matching is a random variable that is (nature picks what it will be) and it is shown that there are some regions in which the efficiency wage generates an effort greater than the initial wage and others where the reverse is the case.

Akerlof and Yellen (1986) purport that there is a positive relationship between wage and effort; this implies that firms can exactly measure the impact of their wage setting on effort. Profit maximizing firms set an efficiency wage such that the effort-wage elasticity is unity (Solow, 1979). Employment level is determined by setting this efficiency wage to marginal productivity of labour $e(w^*) F'(e(w^*), N) = w^*$, where, e , is the effort, w is the going wage, N is the total supply of labour. $e(w^*)$ is independent of the firm's technology, equality of labour supply and demand and the structure of the product market. It is only determined by productivity and efficiency.

Zenou and Jellal (1999) however argue that if jobs are simple so that job matching is rather good, firms can perfectly motivate their workers by using pecuniary compensations in this case (efficiency wages) such that the effort-wage elasticity is equal to one; unemployment is too high and wages are rigid downward. However, if jobs are complex, the job matching is less obvious and the firm has to use non-pecuniary attributes of the job to motivate workers. Effort-wage elasticity is less than one; however, since a job is mostly defined by its technology which is in general not under firms' control (at least in the short run) firms just have to motivate workers by using only monetary compensations. In addition, the authors advocate that firms need not set wages too high since they cannot evaluate the consequences of their wage policy on the workers' motivation. Effort-elasticity of wage is lower than or greater than one depending on the trade-off between effort and marginal productivity, marginal effort and marginal productivity.

Lazear (1981) shows, in providing a way out of the involuntary unemployment trap, that the use of seniority wages solves the incentive to work problem; in his model, he argues that initially workers are initially paid less than their marginal productivity and as they work harder or work effectively over time within the firm, earnings increase until they exceed marginal productivity. The upward tilt in the earnings profile provides the incentive to avoid shirking and the present-value of wages can fall to the market clearing level consequently avoiding involuntary unemployment. However, this creates a moral hazard problem on the employer's side because a firm can declare falsely that a worker shirks or a firm may lay off old workers (paid above marginal product) and hire new workers at a lower wage (credibility problem). Moreover, the seriousness of the moral hazard problem depends on the extent to which effort can be monitored by external auditors which may discipline employers from cheating. Reputation and credibility effects can do the same job as well.

Leonard (1999) argues that minimum wage research has come to be a test of the applicability of neoclassical price theory to the determination of wages and employment. The modern minimum wage controversy is not just a technical quarrel about the sign and magnitude of wage-elasticity coefficients; it is according to the author, the latest chapter in a long methodological discourse over whether and in which domains neoclassical theory can be applied. More importantly, the author asserts that welfare effects depend on wage elasticity of demand. Some workers will receive higher wages and be better off while other workers whose product is less than the new minimum will be laid off, or will work for fewer hours. In his words, "if the quantity of labour refers to employment, then the wage gains of those who keep their jobs must be traded off against the wage losses of those who lose their jobs".

Schmitt and Rosnick (2011) use Card and Krueger's studies of the 1992 New Jersey state minimum wage increase. Their results show, for fast food, food services, retail and low wage establishments in San Francisco and Santa Fe, that city-wide minimum wage increase can raise the earnings of low-wage workers, without a discernible impact on their employment.

Rosen and Moen (2006) argue that efficiency wages and unemployment may arise in equilibrium when output is contractible. In their model, firms offer wage contracts to workers who have private information about their match-specific productivity and effort choice. Firms face a trade-off between inducing more effort and conceding rents. Because hiring is costly, firms choose a contract such that workers with below a maximum match-specific productivity remain employed. The infra-marginal workers obtain information rents and these rents translate to equilibrium unemployment because they do not have any social value in equilibrium as these rents are offset by the corresponding social cost of unemployment.

Shimer, Rogerson and Wright (2004) survey search-theoretic models of labour markets and discuss their usefulness in the analysis of labour market dynamics, labour turnover and wages. Emphasis is placed by these authors on job creation, job destruction and wages.

These are just a few of the large literature on the employment and disemployment effects of the minimum wage.

Section 3: Methodology, Model Specification and Data Sources (Generalized Method of Moments and Two Stage Least Squares)

a. Two- Stage Least Squares (TSLS)

An important assumption of regression analysis is that the right hand side variables or the regressors are uncorrelated with the error term; if this assumption is violated, OLS (Ordinary Least Squares) and WLS (Weighted Least Squares) estimates become biased and inconsistent. Two things might make the error term to be correlated with the independent variables: one, if the independent variables are endogenous and two, if the independent variables are measured with the error term. The problem of endogeneity of the independent variables can be solved by introducing instrumental variables that are truly exogenous that is $E(Z, u) = 0$ such that Z and X are $n \times k$ matrices; however, these instrumental variables must be correlated with the endogenous independent variables that is $E(Z_1 \dots Z_n, X_1 \dots X_n) \neq 0$. The instrumental variables¹ are then used to eliminate the correlation between the right-hand side variables and the disturbances. As the name (TSLS) suggests, there are two distinct stages of regressions involved. First, an OLS regression of each of the variable (endogenous) is done on the set of instruments. The second stage is a regression of the original equation with all the variables (independent) replaced by the fitted values from the first stage of regressions. The outcome of these two simultaneous regressions produces the TSLS estimates.

Formal Representation of the TSLS

Let Z represent a matrix of instruments and let Y and X be the dependent and independent variables respectively. X and Z are both $n \times k$ matrices and Y is a $n \times 1$ matrix. Then the coefficients computed in the two-stages are given by:

$$b_{TSLS} = (X'Z(Z'Z)^{-1}Z'X)^{-1} X'Z(Z'Z)^{-1} Z'Y$$

Where the Z -terms represent the projector matrix³ $X(X'X)^{-1}X'$. The estimated covariance matrix of the coefficients is given by:

$s^2(X'Z(Z'Z)^{-1}Z'X)^{-1}$ where s^2 is the estimated residual variance (square of the standard error of the TSLS regression).

b. Generalized Method of Moments⁴

The starting point of GMM estimation is a theoretical relation that the parameters should satisfy. The aim of GMM modelling is to choose the parameter estimates so that the theoretical relation is satisfied as “closely as possible”. The theoretical relation has to be replaced by its sample counterpart and the estimators are then chosen to minimize the weighted distance between the theoretical and actual values. GMM is a robust estimator because unlike MLE, it does not need the information about the exact disturbances and it encapsulates the heteroskedasticity, unit root and autocorrelation tests⁵. The theoretical relation that the

³ This shows that the x 's (endogenous variables) are regressed on the instruments.

⁴ More details are provided in the appendix

⁵ A Dynamic GMM model simultaneously uses the differences of the variables if non-stationarity occurs and also does check for orthogonality problems. Orthogonality means a transpose of a vector ($k \times 1$) multiplied by another vector with the same dimension yields a scalar (zero). Cross –section and period panel corrected standard errors are used to ensure standard errors are robust.

parameters should satisfy are usually orthogonality conditions between some possibly (non-linear) function of parameters $f(\theta)$ and a set of instrumental variables $Z_t : E(f(\theta)'Z) = 0$, this is the orthogonality condition. The GMM therefore selects parameter estimates that ensure the sample correlations between the instruments and the function f as defined by the criterion function which is: $J(\theta) = (m(\theta))'Am(\theta)$ where $m(\theta) = f(\theta)'Z$ and A is a weighting matrix, is strong. Thus $J(\theta) = (f(\theta)'Z)'Af(\theta)'Z$. Any symmetric positive definite matrix will yield consistent estimate of q . However, a necessary but not sufficient method to obtain an (asymptotically) efficient estimate of q is to set the weighting matrix to the inverse of the covariance matrix of sample moments (m)

An Hausmann test has to be performed to decide on which model (FE or RE) would be desirable. The null hypothesis of a random effect is tested against a fixed effect, if the Chi-Square coefficient is greater than 1 and the probability is less than 0.05, a fixed effects model must be used if not a random effect model becomes handy.

Section 3(c): The Model and Data Sources⁶

For a proper model specification to be done, we have to take into consideration the fact that the minimum wage might impact the average earnings, unemployment and GDP with a lag as discussed by the economists whose works are reviewed in this study. The reasons for the lag in response of minimum wage to average earnings and the other variables are as follows:

1. Firms do not instantaneously respond to a minimum wage hike by increasing prices and this may distort labour market flexibility.
2. Theories have shown that unemployment rates rise when the minimum wage increases but this cannot happen instantaneously; there is a likelihood of slow response due to firm's capacity to absorb costs and productivity.
3. Interactions can take place between some of the variables; it is possible for the real GDP to influence the minimum wage and for the business cycle (proxied by the GDP) to impact unemployment rate.
4. Some of the variables may not necessarily be linear. Studies have shown that GDP, unemployment rate may be quadratic, thus including square terms could correct for biasedness in the parameter estimates.

For the time-series GMM model:

$$RAWE_t = \alpha_1 RMW_t + \alpha_2 RGDP_t + \alpha_3 UE_t + \alpha_4 RMW_t * UE_t + \alpha_5 AR(1) + \varepsilon_t^7$$

⁶ RMW, RAWE, RGDP are real minimum wage, real average wage and real GDP respectively in J\$ while UE represents unemployment. RMWUS, RAWEUS, RGDPUS represent the aforementioned variables respectively in US\$.

⁷ The constant parameter is omitted from the model, the goodness of fit statistic is therefore not interpreted. The GMM model has been corrected for autocorrelation and heteroskedasticity using the Heteroskedasticity

The Instruments used are : two lags each of the real minimum wage, real average wage earnings and unemployment rate. The a-priori expectations are $\alpha_1, \alpha_2 > 0, \alpha_3 < 0, \alpha_4$ and $\alpha_5 > 0$; in other words, changes in the real minimum wage and the real GDP are expected to increase the real average wage earnings while a change in the unemployment rate will likely lead to a decline in the real average warnings over time. Also, the interaction term between real minimum wage and unemployment is expected to be positive to correct for the bias in the sign of unemployment.

For the panel model:

$$Y_{it} = X_{it}\beta + \varepsilon_{it}$$

Where Y represents the dependent variable, i and t represent cross-sections and time respectively. In our model i = 2 and t = 30⁸. X is the number of independent variables in the model and ε is the disturbance term which also has a cross-section dimension. X is a n x k matrix, Y is a n x 1 matrix and the disturbance term is also a n x 1 matrix.

For the TSLS model⁹:

$$RAWEUS_{it} = \beta_1 RGDPUS_{it} + \beta_2 RMWUS_{it} + \beta_3 UE_{it} + \beta_4 UE_{it}^2 + \beta_5 RMWUS_{it} * RGDPUS_{it} + \varepsilon_{it}$$

The a-priori expectations are similar to those of the GMM model except that $\beta_4 > 0$ and $\beta_5 < 0$ and these two coefficients are expected to be statistically significant to correct for the

Autocorrelation Correction option (HAC). In addition, Pre-Whitening runs a preliminary VAR(1) model prior to estimation to remove the correlations in the moment conditions.

⁸ The sample size should have been larger than 30, however, a minimum wage legislation in Trinidad and Tobago did not come into effect until 1997 and a fixed minimum wage has been used since then.

⁹ The instruments are: RAWBUS(2 lags), RMWUS(2 lags), RMWUS*RGDPUS(an interaction term between these two variables), RGDP² (a quadratic term), RMWUS*RGDPUS, RGDPUS², RMWUS*UE, UE², RAWBUS². The standard errors are made robust using the Period- weights Panel Corrected Standard Errors and Covariance (PCSE)

upward bias in unemployment and downward bias in the real GDP. As it will be shown later the square and interaction terms ensure that the a-priori expectations hold.

The data of the minimum wage in Trinidad and Tobago come directly from the Ministry of Labour, Small and Micro-Enterprise; however the Jamaican data are derived from the Statistical Institute of Jamaica. The average wage earnings index is an all industry index (food processing, drink and tobacco, textile garments and footwear; printing, publishing and paper converters; assembly-type and related industries and others). The AWE data in Jamaica are derived from Earnings in Major Establishments Report while the Trinidadian data come from the Central Statistical Office, Abstract of Statistics.

The gross domestic product at market prices is the total value added output of all sectors plus taxes less subsidies. The Jamaican and the Trinidadian data come from index mundi, a data portal that gathers facts and statistics from multiple sources and turns them into easy to use visuals. Also to derive the consumer price index, one calculates the prices of the basket of goods households purchase and uses a base year to deflate the data in order to account for inflation. The CPI index for both countries is derived from CSO office and STATIN office. Unemployment rate data for Trinidad and Tobago are derived from Index Mundi and the Jamaican data are adopted from Labour Force Statistics (various editions) at the Statistical Institute of Jamaica.

Section Four: Model Estimation and Interpretation of Results

Table 1: The GMM Time-Series Model

Dependent Variable: RAWE

Variable	Coefficient	Standard error	T-Value	Significance
RGDP	6.4359* ¹⁰	1.8468	3.4848	0.0018
RMW	-1.4619*	0.5573	-2.6231	0.0146
UE	-22.6899** ¹¹	45.5299	-0.4984	0.6226
RMW*UE	0.2121*	0.0516	4.1122	0.0004
AR(1)	0.2741*	0.1096	2.5015	0.0193
J-Statistic	0.1198*			Null hypothesis of exogeneity of the instruments accepted
Durbin Watson	1.9890			

Source: Author's computations

¹⁰ Significant at 1% significance level

¹¹ Not significant at 1%, 5% and 10% significance levels.

Table 2: The TSLS Panel Data Model

Effect Specification: Cross section fixed (dummy variables)

Dependent Variable: RAWE

Variable	Coefficient	Standard error	T-Value	Significance
RGDPUS	0.000734**	0.009013	0.081426	0.9360
RMWUS	2.048578*	0.365614	5.603118	0.0000
UE	-28.13754*	10.52452	-2.673522	0.0150
UE ²	1.537513*	0.435514	3.530342	0.0022
RMWUS*RGDPUS	-0.000117**	0.000165	-0.707361	0.4879
Durbin Watson	1.503574			
Instrument Rank	11.00000			
Standard error of coefficient	10.89444			

Source: Author's computations

Economic Implications of Results

From the GMM estimation results, a unit change in the real minimum wage yields a decrease of J\$2 in the mean of the real average earnings (even though nominal wages may rise) when all the other explanatory variables are zero, this indicates that a hike in the minimum wage increases the costs of Jamaican firms who already face huge cost constraints. It is therefore not surprising that, due to the inability of firms to absorb costs, such costs are passed on to consumers who could be the workers in form of high prices; this reduces the purchasing power

of their earnings. This indicates that workers who are in the production and ancillary sub-sectors earn less directly because Jamaican firms reduce their income and indirectly such workers and the average Jamaican consumer will have to expend more on goods and services. In addition, the IMF agreement that is still not in place has led to the continuous slide of the Jamaican dollar because of the government's inability to source for funds for development from bilateral and multilateral institutions, the consequence of this is that net international reserves have been on a downward trajectory and firms' import costs have gone up, this neutralizes the positive impact of an increase in minimum wage if introduced.

In addition, a unit change in the real GDP produces approximately \$6 boost in real average earnings. This is clearly expected; high real income raises real average earnings and as the economy grows in real terms average incomes grow in real terms as well. However, just a \$6 increase in the real average earnings given a change in the real GDP is too minute because the Government of Jamaica spends a lot on servicing debt and paying for capital goods. The first attempt at running the GMM, without an interaction term between unemployment and real minimum wage, shows that a unit change in the unemployment rate increases real average wage, this result does not lend itself to economic theory. However, the inclusion of an interaction term between the real minimum wage and unemployment corrects for this bias. After the inclusion of the interaction term, a unit change in the unemployment rate does not affect the real average earnings.

The problem of autocorrelation in the GMM model, after using HAC and Pre-Whitening options, makes it mandatory to include an AR(1) (Autoregressive process of order (1) to correct the positive correlated errors. The AR(1) coefficient is indeed statistically significant. From the Panel Two Stage Least Squares, the real GDP, conditional on an interaction term between the

real GDP and the real minimum wage, has a minute positive but insignificant impact on the real average wage in both countries when the data are pooled together. A unit change in the real GDP does not have any impact on the real average wage. This clearly shows that a high real GDP does not guarantee that real average earnings will increase in both countries, it all depends on how productive and efficient firms and workers are. In terms of the real minimum wage, a unit change in this variable brings about a US\$2 dollar increase in the real average wage when the other explanatory variables are zero. This clearly indicates that Jamaican and Trinidadian production workers and shop keepers who earn below the average wage will see a boost of \$2 in their average wage following a minimum wage hike if implemented. In addition, the governments of both countries need not contemplate about raising the minimum wage now. Boosting the productive capacity of firms and improving workers' productivity is a more attractive policy measure that should be introduced now and then a minimum wage policy may be used thereafter.

When a preliminary TSLS model without a square unemployment term was executed, a unit change in the unemployment rate raises real average wage, but when I introduce a square term, the upward bias of the unemployment coefficient is corrected. A unit change in unemployment rate yields a US\$28 decrease in the real average wage; this decrease clearly outweighs just a US\$2 increase in the real average wage following a unit change in the minimum wage. Consequently, targeting the unemployment rate is a more viable option for the governments of Trinidad & Tobago and Jamaica rather than raising the wage floor, raising the minimum wage could actually increase the unemployment rate as predicted by the competitive theory.

Section V: Summary, Conclusion and Recommendations for Further Studies

The analyses done so far have shown that there are mixed results about the impact of a minimum wage policy on average earnings. The GMM estimation shows a unit change in the real minimum wage reduces average earnings of workers in Jamaica; however, the Two Stage Least Squares regression results indicate that real average earnings in both countries actually increase as the minimum wage rises. The question that must be raised is why is there a disparity in the effects of the minimum wage? One obvious answer is that Jamaica had been using the minimum wage since the 1980s but Trinidad just started using this policy in 1997 and more so, because the Jamaican economy is not as big as the Trinidadian economy. In addition, firms in both countries have different capacities of absorbing the costs of a minimum wage hike. In Jamaica, firms are already cost-strapped but Trinidadian firms have larger capacities and more resources at their disposal to absorb the sudden surprise of a wage hike. Trinidad has oil and refineries but Jamaica imports oil, consequently firms in Trinidad can decide to pay their workers more when minimum wage rises and still make reasonable profit but Jamaican firms will simply respond to such hike by cutting back on employment immediately. This difference in averseness to a minimum wage hike in both countries is therefore not surprising.

It is recommended that this study be replicated for other Caribbean countries in order to fully come to an agreement about the overall effect of minimum wage on real average earnings in the Caribbean. Two, unemployment rates in both countries must fall for workers to realize a reasonable increase in their real average earnings. The inflation rates in Jamaica and Trinidad have to be kept lower than they are presently to hedge against a slide in the purchasing power of consumers in both countries. Firms must also reduce organizational slack and improve their

efficiency and productivity. Real GDP growth has been at low ebb in Jamaica, urgent action is needed to reverse this trend so that the growth rate of real average income can be sustained.

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APPENDICES

The generalized method of moments was made popular by Hansen (1982) who showed that the basic idea underlying the GMM was to obtain a set of moment conditions that the parameter of interest θ should satisfy. These conditions are denoted as:

$$E(m(y, \theta)) = 0$$

The method of moments estimator is replaced with its sample analog:

$$\left(\sum_t m(y_t, \theta)\right)/T = 0 *$$

The condition in equation * will not be satisfied for any θ if there are more restrictions (m) than are parameters θ . To allow for such over-identification, the GMM is defined by minimizing the following criteria function:

$$\sum_t m(y_t, \theta) A(y_t, \theta) m(y_t, \theta) \text{----- (1)}$$

Equation 1 estimates the distance between m and θ and A is a weighting matrix that weights each moment condition. If one writes the equation as an orthogonality condition between the residuals of a regression equation: $u(y, \theta, X)$ and a set of instrumental variables Z, so that:

$$m(\theta, y, X, Z) = Z'u(\theta, y, X)$$

The OLS is then obtained as a GMM estimator with the orthogonality conditions: $X'(y - X\beta) = 0$. An important aspect of specifying a GMM problem is the choice of a weighting matrix A. An optimal $A = \hat{\Omega}^{-1}$. $\hat{\Omega}$ is the estimated covariance matrix of the sample moments (m). Consistent TSLS estimates for the initial estimate of θ is used to form the estimate of Ω .

White's cross-section heteroskedasticity consistent covariance matrix for the cross-section is specified as: $\hat{\Omega}_w = \hat{\Gamma}(0) = 1/T - K \left(\sum_{t=1}^T Z'_t u' u_t \right)$ where u is the vector of residuals and Z_t is a k x p matrix such that p moment conditions at (t) may be written as $m(\theta, y_t, X_t, Z_t) = Z'_t u(\theta, y_t, X_t)$

The Heteroskedasticity and Autocorrelation Consistent option is used to correct for both autocorrelation and heteroskedasticity in the data. The following is a specification of this option:

$$\hat{\Omega}_{HAC} = \hat{\Gamma}(0) + \left(\sum_{j=1}^{T-1} k(j, q) (\hat{\Gamma}(j) + \hat{\Gamma}'(j)) \right)$$

$$\text{Where } \hat{\Gamma}(j) = 1/T - K \left(\sum_{l=j+1}^T z'_{t-j} u u_{t-j} z_t \right)$$

Table 3: Descriptive Statistics (Panel Data)

Variable	Mean	Median	Standard Deviation	Maximum	Minimum
RGPDUS	4517.079	860.6690	6278.405	17557.92	7.0562
RAWEUS	67.8389	39.2614	71.8022	208.1571	1.6868
RMWUS	39.0143	44.8730	15.6030	65.0492	11.7086
UE	11.0400	11.2000	3.4637	16.5000	4.6000

Table 4: Descriptive Statistics (Time Series Data)

Variable	Mean	Median	Standard Deviation	Maximum	Minimum
RAWE	3453.135	2962.173	3501.190	7727.766	10.5453
RMW	1386.218	978.2663	1241.669	3200.00	73.7619
RGDP	28817.32	5686.809	39476.75	110429.3	585.1181
UE	11.0400	11.2000	3.4636	16.5000	4.6000

Figure 1(i): KERNEL DENSITY PLOTS FOR TIME-SERIES DATA (JAMAICA)

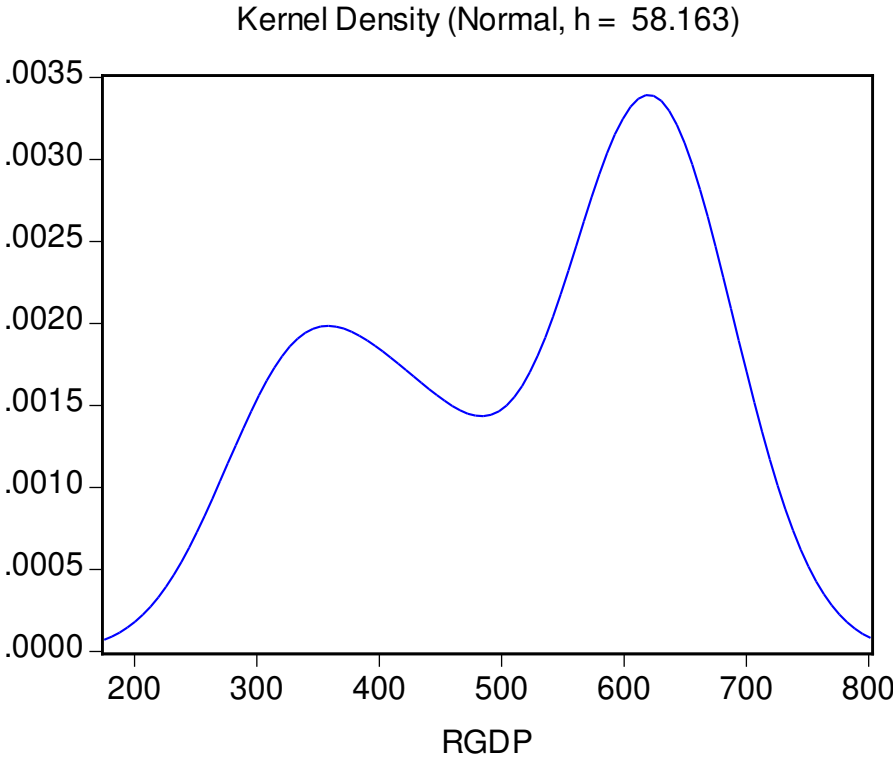


Figure 1 (ii)

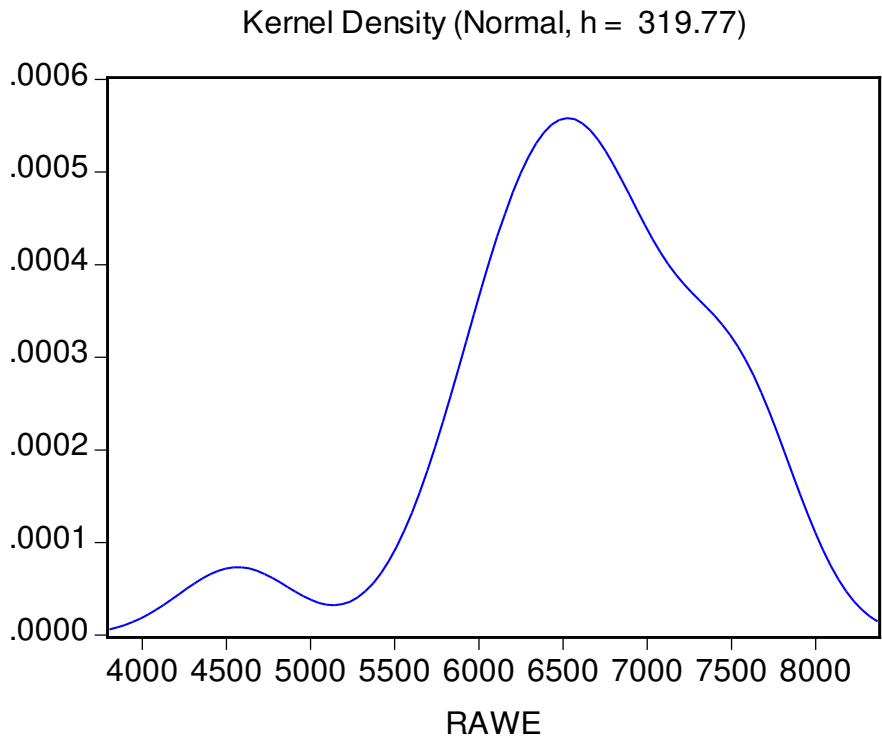


Figure 1 (iii)

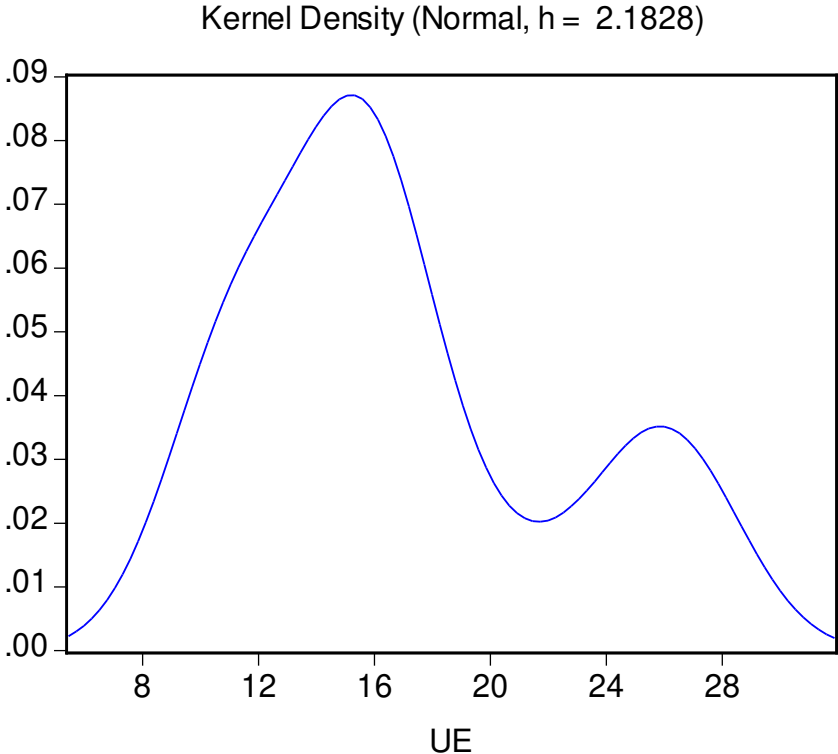


Figure 1 (iv)

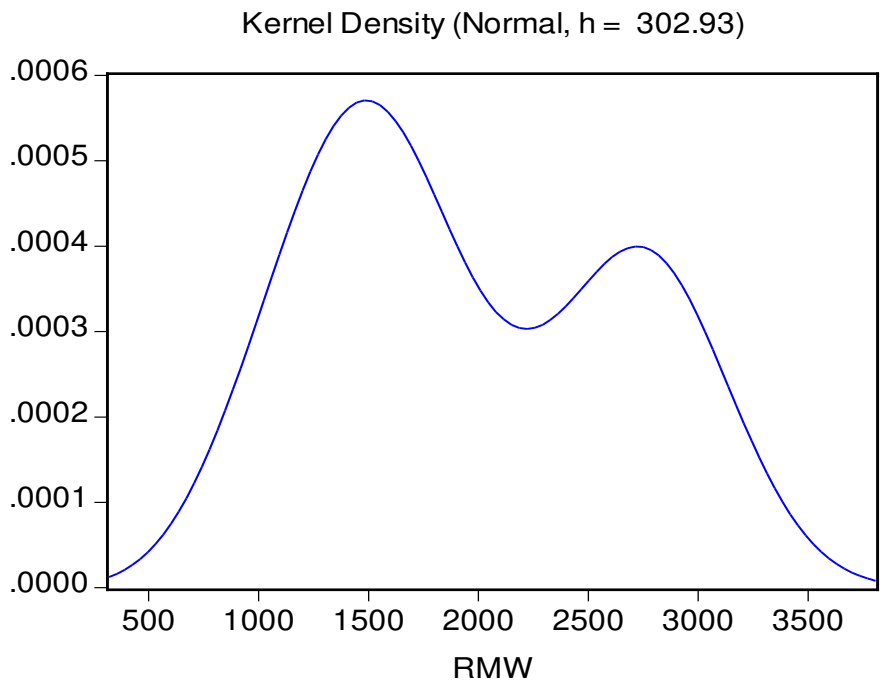


Figure 2 (i): KERNEL DENSITY GRAPHS FOR THE PANEL DATA

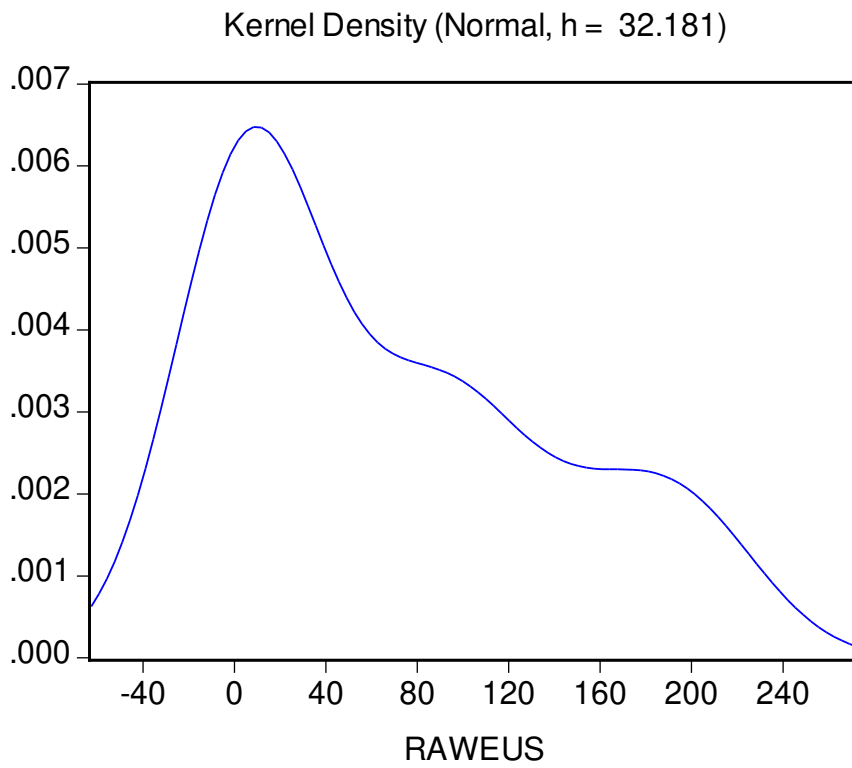


Figure 2(ii)

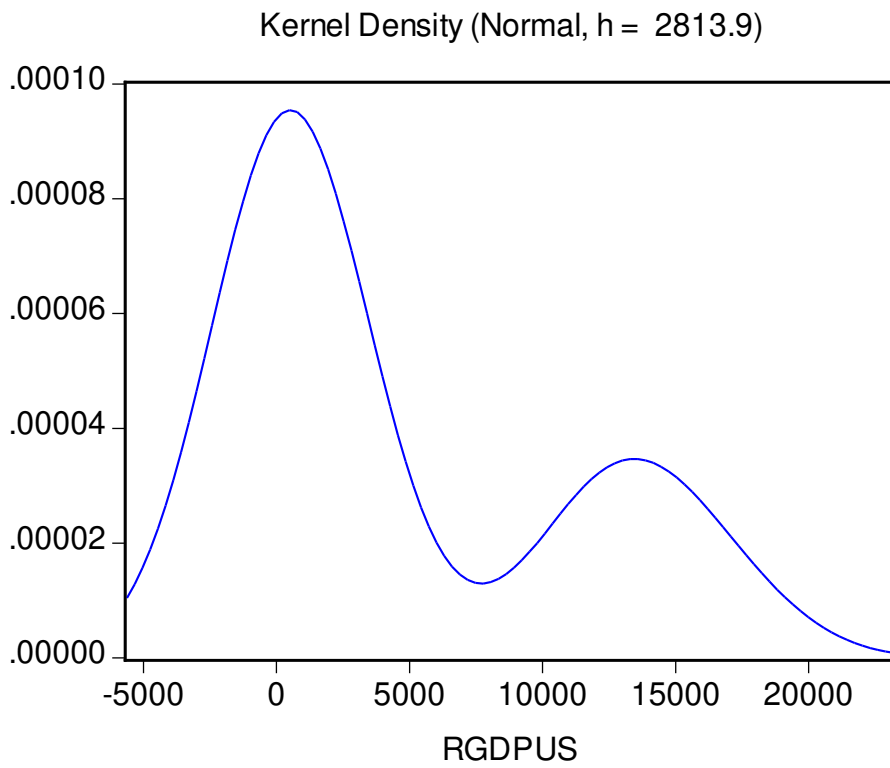
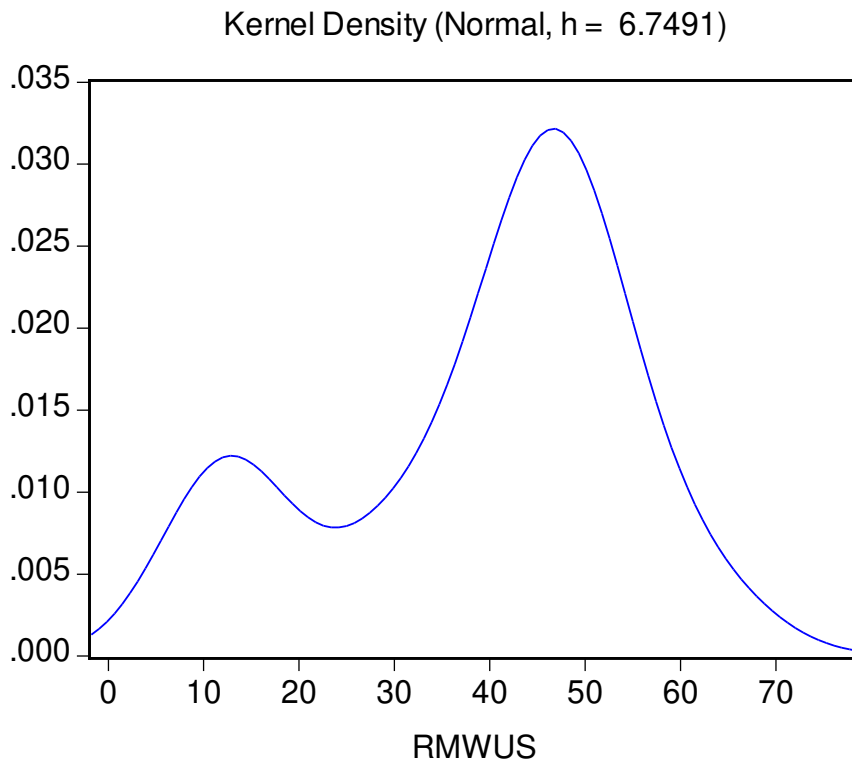


Figure 2(iii)



ⁱThe GMM and the TSLS methods are similar in that both make use of instrumental variables; however, the interpretation of tests of significance are somewhat different. TSLS uses the total number of observations multiplied by the TSLS R^2 (this is the calculated test statistic for the overall model), this is compared with a chi-square distribution at 5% significance level with $l - k$ degrees of freedom (l is the number of instruments and k is the number of parameters). If the tabled chi square value is less than the calculated value, the null hypothesis of exogeneity is failed to be accepted. A regression without a constant renders the coefficient of variation useless. In contrast, The GMM test statistic for the model is T multiplied by the Hansen's J-Statistic, if this statistic is less than

the chi-square statistic at 5% significance level with $l - k$ degrees of freedom, the null hypothesis cannot be rejected.