

US Job Creation Growth Rate and Sub-Sector Vulnerability to Economic Shock

Rexford Abaidoo
University of Maryland Eastern Shore

This study employs modified vulnerability model to measure the probability of being vulnerable to economic shock features associated with selected sectors and sub-sectors of the US economy. Marginal effect Probit results show that job creation growth rate features characterizing sectors and sub-sectors of the US economy are significant in estimating probability of being vulnerable to economic shock. This study finds that a percentage growth in job creation rate all things being equal, decreases the likelihood of being vulnerable to economic shock among some selected sectors and sub-sectors of the US economy; However, this decreasing probability of being vulnerable to economic shock given a percentage growth in job creation rate, tend to vary significantly among sectors and sub-sectors of the economy tested. This study also finds that for some sub-sectors of the US economy, job creation growth rate features does not fully capture or explain the potential of being vulnerable to economic shock.

INTRODUCTION

Comparatively, the US economy vis-à-vis other economies around the world, has shown more resilience in the face of economic shocks for more than half a century. This ability to absorb and quickly rebound after a major shock has often been perceived as a product of the robust and highly productive nature of its economic sectors and sub-sectors. However, this perceived robust economy began to exhibit signs of extreme vulnerability during the later part of 2008. This period witnessed the onset of one of the worse economic downturn in recorded history since the great depression (the recession of 2008). The devastating impact of this economic downturn on the core sectors and sub-sectors of the economy, and ultimately on households they employ, rekindled the debate on the perceived robustness of the US economy (sectors) to a major economic shock. The economic shock of 2008 brought about by the mortgage crisis in the financial sector to some extent challenged the long espoused paradigm- the resilience of US economy to economic shocks and robustness of its sectors and sub-sectors.

Ongoing progress towards recovery after the 2008 economic shock constitutes a painful reminder that the structure of the US economy might not be as robust as we've been made to believe. Although the source of the 2008 recession is not in dispute, economists and analysts diverge significantly on the factors responsible for the economy's prolonged recovery after the 2008 shock. One key question dominates the debate on why the rebound process has been slower than expected. Researchers defer on whether the painfully slower than expected rebound process can be attributed to the shocks' sheer magnitude (global nature) and severity; or growing susceptibility of the various sectors and sub-sectors of the US economy to economic shock. This study subscribes to the notion that the impact of any shock or perturbation on structures of an economy depends more on the degree of vulnerability of its sectors and sub-sectors to the

shock. This position is inconsistent with growing sentiments suggesting that the slow recovery process since the 2008 shock can be attributed to its severity and global dimension. However, proponents of this view cannot for instance explain why some economies around the world such as China grew even in the face of the economic shock; whereas others such as Germany etc have rebounded faster than the US economy. This study hinges on the assumption that the ultimate impact of a given shock to an economy depends more on how its sectors and sub-sectors absorb and respond to the shock and less on the shock's magnitude. Additionally, this study further projects that sectors and sub-sectors of an economy will tend to exhibit varied vulnerability to shock properties; a condition which could explain why some sectors of the economy tend to cope better during economic shock.

Varied vulnerability to shock properties could also help explain why some sectors and sub-sectors of an economy tend to achieve a faster rate of recovery after a major economic shock than others. Available literature shows that depending on the nature of the shock, some sectors of the US economy tend to perform relatively better during economic downturn while others are grossly impacted and decimated in the process. If the impact of an economic shock depended solely on its magnitude and severity as some suggest, then one would expect that effects on sectors and sub-sectors would tend to be evenly distributed, all things being equal. However, available data on the performance of economic sectors after major shocks do not support this claim. Although the impact of a shock on a given sector of the economy might reflect the strength of the shock to some degree, this study posits that the ultimate impact of a shock on sectors of an economy could be more explained by the sector's unique degree of exposure and capacity to cope features. In other words, whether a sub-sector of an economy succumbs or absorbs a given shock depends more on its vulnerability to that shock. If this level of exposure and capacity to cope features among economic sectors and sub-sectors could be measured, it could help in our understanding of propensity to succumb to economic shock dynamics facing sectors and sub-sectors of the US economy. This study intends to measure and classify selected sectors and sub-sectors of the US economy according to their level of susceptibility to economic shock using specific job creation growth rate features.

Existing literature generally supports the view that sectors of the US economy tend to exhibit unique features in terms of growth, productive capacity, job creation capacity etc. The lagging feature, however, is an empirical work which categorizes sectors and sub-sectors of the economy according to specific vulnerability to economic shock features. This condition is assessed in this study using percentage growth in specific job creation growth potential parameters. Additionally, a major contribution of this study is its assessment of vulnerability to economic shock conditions at the micro-level (sub-sectors of the economy) instead of basing it on the known traditional sectors of the economy. Micro-level analysis is crucial because a shock to the services or industrial sector of the economy for instance, might not impact all its sub-sectors equally; because sub-sectors in the same sector of an economy may tend to exhibit varying degrees of exposure and capacity to cope dynamics. This study attempts to address this sub-sectoral vulnerability to economic shock gap in the literature by capturing propensity to succumb to economic shock characteristic exhibited by selected sectors and sub-sectors of the US economy.

Available trend data indicates growth features characterizing sectors and sub-sectors of the economy are often constrained by the weakening impact of economic downturns or shocks. Although existing literature provides some information on how sectors and sub-sectors perform in the face of economic downturn, the focus as indicated earlier has often been on the strength of the economic shock (supply-side or demand-side shock). Less emphasis is often placed on the capacity to cope potential of various sub-sectors of the economy in the face of shocks. This study intends to share light on this propensity to cope features associated with selected sectors and sub-sectors of the US economy; and how the feature defines sector performance during economic shock.

The rest of the study is structured as follows: section two offers a succinct account on how known specific shocks impact productive activities in the US economy. Section three reviews performance and job creation potentials of selected sub-sectors of the US economy. Section four introduces and quantifies the concept of vulnerability; and further estimates vulnerability to economic shock features of selected sub-sectors of the US economy. Section five develops the vulnerability to economic shock function and the Probit marginal effect functions used in measuring the probability of being vulnerable to economic

shock. The final section reports results and major findings of this study and draw potential policy implications of the findings.

LITERATURE REVIEW

The literature abounds with evidence of how economic shock such as oil shock distorts productivity and other economic activities; and how firms and standard of living of households are ultimately impacted. Significant number of these studies focusing on how economic shock influence economic activities have favored examining the relationship between specific macroeconomic shock (eg. oil shock) and GDP growth or economic activity. For instance, Hamilton (1983) showed that unexpected oil prices changes or shocks granger causes changes in output growth. Carruth, Hooker and Oswald (1997), Daniel (1997), and Hamilton (1996b) all found robust associations between oil price shocks and fluctuations in economic activity. Additionally, Loungani (1986), Davis (1987a, b), Mork (1989), Ferderer (1996), Lee, Ni and Ratti (1995) and Hamilton (1996, 2003), have all concluded that Rapid oil price changes (a macroeconomic shock) has asymmetric effects on aggregate economic activity; that is, whereas oil price hikes lead to recessions, lower oil prices do not result in economic booms. These studies also show that effect of oil price increases or shock on economic activity depends not only on the size of the shock, but also on prevailing conditions during the price hike.

Apart from oil shock which dominates the macroeconomic literature, further review indicates the US economy is also often jolted (positively and negatively) by other supply and demand side shocks which impacts internal economic activities characterizing its sectors and sub-sectors. For instance, in his study of dynamic responds of US economy to monetary shocks, Christiano, Eichenbaum and Evans (1998) focused on how the economy responds to specific exogenous shocks. The study showed that monetary shocks significantly impact economic activity; and that the impact of shocks is often influence to some extent by the model used in a particular study. Cochrane (1994) employed tightly specified VARs to ascertain specific shocks responsible for business cycles. He concluded that contrary to perceptions, technology shocks are not important source of variation in output and consequently GDP growth. Cochrane's work also showed that no single class of exogenous shock from either supply or demand side is responsible for business cycles. Lastrapes (2006) further illustrated how U.S. commodity prices responds to monetary shocks by assuming block exogeneity and diagonality. Lastrapes found that positive U.S. productivity shocks have negative effects on commodity prices, while positive U.S. monetary shocks have positive effects on prices; this condition indicates shocks in general impacts economic activity through structured transmission process.

As indicated earlier, most reviewed and existing studies focus on specific macroeconomic shock element, such as oil shock, monetary shock etc. This study pursues a different approach. Although this study recognizes that the type of shock is critical in assessing its ultimate impact on sectors and sub-sectors of the US economy, I have chosen to pursue a holistic approach which aggregate all shock variants into a single shock variable or parameter. This aggregation method has been informed by the following: first, this study subscribe to the notion that the ultimate impact of a shock depends more on the vulnerability of sectors and sub-sectors and less on the strength of the shock. Consequently, the role of a specific type of shock though critical is viewed as minimal. Second, aggregation eliminates the possibility of having sectors or sub-sectors of the economy exhibiting varied vulnerability to different economic shock parameters.

The above review illustrates just a fraction of the literature on how supply and demand side shocks impacts US economic activity. The studies mainly reveal how specific shock to the US economy ultimately perturbs noted economic indicators and other elements of interest. This study argues that any negative impact on US economic activity due to shocks presupposes that the economic activity in question might have already been vulnerable to that shock. According to theorized concept of vulnerability (to be illustrated shortly), any object of influence (e.g. sectors and sub-sectors of an economy) can only be perturbed if it is (1) somehow exposed to that shock and (2) lacks the capacity to absorb or repel the influence being exerted by the shock. Existing literature however provide very little

information on these dimensions or the potential of becoming vulnerable to economic shock dynamics characterizing different sectors and sub-sectors of the US economy.

SUB-SECTOR JOB CREATION PERFORMANCE OF US ECONOMY

Mining Sub-Sector

The mining industry is made of five minor industry segments defined according to the nature of resource they produce. The five segments are oil and gas extraction, coal mining, metal ore mining, nonmetallic mineral mining and quarrying; coupled with support activities for the mining industry as a whole. According to the Bureau of Labor Statistics, the mining sub-sector employed approximately 717,000 wage and salary workers in 2008; 161,600 of these were employed in oil and gas extraction segment alone; 80,600 in coal mining segment, 39,900 in metal mining segment, and 107,200 in nonmetallic mineral mining segment of the sub-sector. In addition to employment avenues emanating directly from the mining companies, data further show that the sub-sector also created approximately 327,700 jobs in support activities for the industry over the same period. The sub-sector further accounts for millions of other jobs created by firms and industries who depend on its products as basic raw materials. Mining jobs in the various segments of the sub-sector are heavily concentrated in parts of the country where large resource deposits exist.

Construction Sub-Sector

The construction sub-sector of the US economy is further divided into three major segments. The *construction of buildings* segment is engaged in building residential, industrial, commercial, and other household structures. The second segment under this sub-sector, the *heavy and civil engineering construction* mainly engages in the construction of sewers, roads, highways, bridges, tunnels, and other projects related to the nation's infrastructure; the backbone of the nation's economy. The third segment is made up of *Specialty trade contractors* who perform specialized activities such as carpentry, painting, plumbing, and electrical work which are integral part of other construction activities.

The Construction sub-sector of the economy according to the Bureau of Labor Statistics employed over 7.2 million wage and salary workers and 1.8 million self-employed and unpaid family workers in 2008. Data also show that about 64 percent of wage and salary jobs in the sub-sector were in the specialty trade contractors segment, that is mainly in the plumbing, heating, and air-conditioning; electrical; and masonry. 23 percent of the jobs in the sub-sector were in residential and nonresidential building construction. The rest were in the heavy and civil engineering construction segment. Employment in the sub-sector unlike the mining sub-sector is distributed all over the country. Data indicates that there were about 884,300 construction establishments in the country in 2008. 269,700 of these were in the building construction segment; 57,600 in the heavy and civil engineering construction or highway segment; and 557,000 were specialty trade contractors. Growth in these establishments has been found to contribute significantly to job creation growth in the sub-sector.

Manufacturing Sub-Sector (Motor Vehicle and Parts Manufacturing)

The motor vehicle and parts manufacturing sub-sector constitutes one of the significant job creation segment of the US economy. In 2008 there were about 9,100 establishments manufacturing complete motor vehicles and parts. These establishments ranged from small parts plants employing few workers to huge assembly plants employing thousands of workers. The motor vehicle parts manufacturing section accounts for most establishments and engages the most workforce in the manufacturing sub-sector. Available data show that about 7 out of every 10 establishments in the manufacturing sub-sector manufactured motor vehicle parts—made up of electrical and electronic equipment; engines and transmissions; brake systems; seating and interior trim; steering and suspension components; air-conditioning components etc. The Motor vehicle and parts manufacturing segment of the sub-sector employed about 877,000 workers in 2008. Most of these jobs, about 62 percent, were concentrated among firms engaged in the manufacture of motor vehicle parts. About 22 percent of workers in the sub-sector

on the other hand were employed in firms assembling complete motor vehicles, while 16 percent worked in firms producing truck trailers; motor homes, travel trailers, campers, trucks etc. The sub-sector also directly supports other auxiliary firms whose activities are integral to its operations.

Wholesale Trade Sub-Sector

The wholesale trade sub-sector is categorized into two main types: Merchant wholesalers and wholesale electronic markets and agents and brokers. *Merchant wholesalers* generally assume responsibility for goods they sell; they buy and sell goods on their own account. The merchant wholesale segment includes individual sales offices and sales branches (but not retail stores) of manufacturing and mining enterprises. Merchant wholesalers deal in both durable and nondurable goods. Establishments in this branch of wholesale trade sub-sector engages in sale of products such as motor vehicles, furniture, construction materials, machinery and equipment, metals and minerals etc. Firms in the wholesale electronic markets and agents and brokers segment on the other hand arrange for the sale of goods owned by others on a fee or on commission basis. This segment includes agents and brokers as well as business-to-business and markets that use electronic means such as the Internet or Electronic Data Interchange (EDI), to facilitate wholesale trade. In 2008, the Wholesale trade sub-sector engaged about 6 million wage and salary jobs. 90 percent of the establishments in the industry were mainly small entities employing about 20 workers.

Retail Trade Sub-Sector

Firms in the retail trade sub-sector of the economy are engaged in sale of large assortment of items. Majority of entities in this sub-sector are department stores—including discount department stores, supercenters and warehouse club stores, as well as "dollar stores," which sell a wide variety of both expensive and inexpensive merchandise. Department stores sell extensive selection of merchandise with no dominating line item. Goods normally include apparel, furniture, appliances, home furnishings, cosmetics, jewelry, paint and hardware, electronics, sporting goods etc.

The clothing, accessory, and general merchandise stores constitute one of the largest employers in the US economy. The segment alone employed about 4.5 million wage and salary workers in 2008. Compared to some sub-sectors of the economy which are mostly concentrated in specific geographical areas of the country such as the mining sub-sector, firms in the retail trade sub-sector could be found across the economy and employs workers in all parts of the country, from the largest cities to the smallest towns. Department stores alone according to available data accounted for about 34 percent of jobs in the retail sub-sector, with only about 7 percent of establishments. In 2008, approximately 68 percent of workers in this sub-sector were employed in clothing, accessory, and general merchandise stores.

Finance, Insurance, Real Estate Sub-Sector

The finance, insurance and real estate sub-sector of the economy has witnessed appreciable growth over the past decade. The sub-sector accounts for significant portion of job creation potential in the US economy. Available sector performance indicator show that these segments of the economy employed over 6 million wage and salaried workers in 2008 and indirectly sustained other job creation and retention activities in the country over the same period. The sub-sector is made up of the financial segment dominated by commercial banks, savings and loan associations, credit unions etc. According to trend data, commercial entities in the sub-sector with their affiliates employed over 1.8 million workers in 2008. About 74 percent of jobs were in commercial banking; the rest were concentrated in savings institutions and credit unions. The insurance industry on the other hand consists mainly of insurance carriers and insurance agencies and brokerages; the industry accounted for about 2.3 million of the jobs in this sub-sector in 2008. Although job growth and retention in the real estate segment suffered significantly over the period (2008) due to the mortgage crisis, the segment over the years has played critical role in sustaining job creation and retention potential in this sub-sector according to sourced data.

Transportation, Communication and Utility

Transportation, Communication and Utility sub-sector of the US economy covers firms and agencies engaged in the provision of passenger and freight transportation, communication services, and electricity, gas, steam, water and sanitation services. The sub-sector has enjoyed appreciable growth in recent times with substantial part of this growth emanating from communication and utility segment. This growth has been brought about by advances in technology in the communication segment coupled with continual growth in demand for utilities services across the country. Sustained growth in the sub-sector has occurred concurrently with growth in job creation potential for the various firms and businesses found in the sub-sector.

CONCEPT OF VULNERABILITY

Moser's Sensitivity and Resilience Framework

In a characterization of the concept of vulnerability, Moser (1998) introduced two-tier model of vulnerability based on the concept of sensitivity and resilience; which was an adaptation from the field of agro-ecology and natural resource management. Moser's framework of vulnerability revolves around two core factors. Moser theorized that vulnerability of a system depends on the external and the internal sensitivity of that system to external threat or shock; and the tensile strength of the 'system' (e.g. sub-sector of an economy) to recover from an external hazard or shock (resilience). In other words, according to Moser's characterization, vulnerability depends on the sensitivity of an object or entity (sectors of an economy) to external shock coupled with the ability to effectively or otherwise absorb or repel the shock. In Moser's words: "Analyzing vulnerability involves identifying not only the threat but also the 'resilience' or responsiveness in exploiting opportunities, and in resisting or recovering from the negative effects of a changing environment" (Moser 1998, p.3). Thus to Moser, vulnerability of a subject depends more on the subject's make-up in terms of its sensitivity and resilience to external threats or shock. The chart below illustrates Moser's two dimensions of vulnerability.

FIGURE: 4.1
MOSER'S TWO DIMENSIONS OF VULNERABILITY²

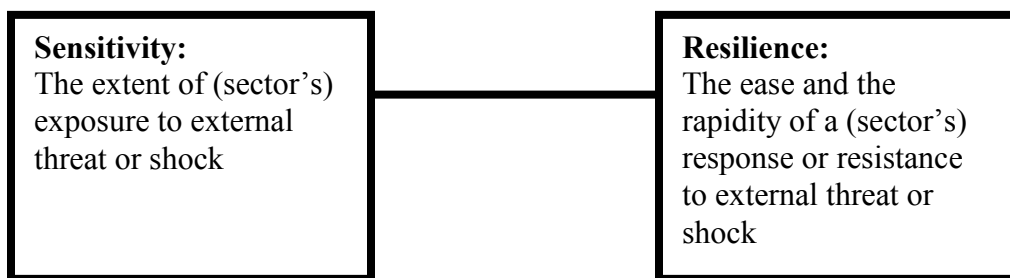


Figure 4.1 illustrates Moser's conceptualization of key features influencing the extent of vulnerability to shock or threat. Extending this concept to condition of sectors of an economy, this study argue that varying degrees of sensitivity and resilience (outlined in Figure 4.1) ultimately determines the extent of vulnerability to shocks features characterizing sectors and sub-sectors of an economy. These dimensions of vulnerability outlined above (Figure 4.1) however differ significantly in the role they play in creating conditions of vulnerability. The sensitivity dimension highlight the degree of exposure and responsiveness of a sector or sub-sector to an external shock which has the potential to distort a hitherto stable condition critical in promoting productivity and job growth. The resilience dimension on the other hand focuses on the capacity to cope or endurance features associated with sectors and sub-sectors of the economy in the face of shocks. It also highlights the ease to adjust features associated the object in question, in this case sectors and sub-sectors of the US economy. A relatively low degree of sensitivity to

external shocks or threats, coupled with a high resilience to shocks potential constitutes a low potential of being vulnerable to economic shock and vice versa according to Moser's vulnerability characterization.

Quantifying Vulnerability

Defining specific criteria for quantifying vulnerability of an entity to a given shock has been found to be challenging because, the condition of being vulnerable is not a directly observable phenomenon (Downing et al., 2001). Compounding this problem is the fact that to some degree, every entity could be perceived as being vulnerable to some kind of external threat or shock depending on the entity's level of exposure. However despite these challenges in quantifying vulnerability, a number of quantitative and semi-quantitative methods have been proposed and developed to measure the condition of being vulnerable to external shock, threat or deprivation. These quantitative methods have been used predominantly in the social and environmental science literature (e.g. Pritchett et al., 2000). In the social sciences literature where the concept of vulnerability has been applied mainly to the condition of poverty and standard of living, the literature show that quantifying vulnerability often calls for identification of some core features. These features include a predetermine threshold or cut-off point such as poverty line, against which a given household or an individual could be deemed as being vulnerable to poverty or otherwise. This study adopts modified version of this approach to quantifying vulnerability to determine how susceptible sub-sectors of US economy are to sudden economic perturbation.

Estimating Sectoral Vulnerability to Economic Shock

To estimate vulnerability to economic shock features associated with selected sectors and sub-sectors of the US economy, it's cogent that the term economic shock is defined. Economic shock in this study refers to any sudden perturbation in the economy (demand or supply-side shock) which negatively impacts productive and job creation capacity of sectors and sub-sectors of the economy. This perturbation could be oil shock, natural disasters, general demand stagnation due to uncertainty etc. A sub-sector or sector of the US economy is considered vulnerable to economic perturbation when at any point in time it could be shown that it's expected job creation growth rate lags behind estimated job growth augmenting GDP indicator. Job growth augmenting GDP indicator in this study is constructed using what economists believed to be the ideal GDP growth rate parameter. An ideal GDP growth rate refers to GDP growth trend which is neither too fast to cause inflation nor too slow to cause recession. Most economists believe this ideal GDP growth rate is in the range of 2%-3%. In this study, 3% GDP growth rate is used as a stable condition defining job creation potential by sectors and sub-sectors of the US economy.

Based on these definitions, a sub-sector or sector of the US economy is considered vulnerable to economic shock if there exist a likelihood that it's expected job creation growth rate (Ej_{t+1}), will lag behind a stable job creation growth rate (Ijr) given an ideal GDP growth rate. A stable job creation growth rate defines a condition in which productive capacity conditions characterizing sub-sectors affords them the resilience crucial in reducing vulnerability to economic shock. In this study, this stable condition is deemed to exist during sustained positive growth trend in 'ideal GDP growth'.

EMPIRICAL FRAMEWORK

Model Specification

Vulnerability to Economic Shock

Vulnerability to economic shock model adopted in this study relies heavily on vulnerability to poverty function developed by Chaudhuri, Shubham, Jyotsna Jalan, and Asep, Suryahadi (2002) and Chaudhuri, Shubham (2003). Following Chaudhuri et al. (2002), Sub-sector vulnerability to economic function is modeled as follows:

$$V_{s(i)(t)} = Pr_t(Ej_{t+1}) < (Ijr) \quad (1)$$

Where $V_{s(i)(t)}$ = vulnerability of a sub-sector to economic shock at time t

$Pr_t =$ Ex-ante probability distribution parameter at time t

$Ejrt_{t+1} =$ Expected job creation growth rate

$Ijr =$ Stable state job creation growth rate

Equation 1 states that vulnerability of a sub-sector or sector to economic shock is a function of the present (t) probability that expected job creation growth rate characterizing a sub-sector will be less than predetermined stable state job creation growth rate. $V_{s(i)(t)}$ is modeled as dichotomous dependent variable of being vulnerable to economic shock (1) or (0) otherwise.

Probit Model

The condition of being vulnerable to economic shock is deemed as a binary condition of either being vulnerable to economic shock (1) or (0) otherwise. Sub-sectors of the US economy are presumed to exhibit two operational conditions; that is, they are either vulnerable to economic shocks or otherwise based on level of exposure and capacity to cope threshold. The likelihood of being vulnerable to economic shock among sub-sectors is measured using marginal effects analysis based on Probit model.

The basic Probit function is stated as:

$$Pr(Y = 1|X_1) = \Phi_{x\beta} = \int_{-\infty}^{x\beta} \phi(t)dt = \int_{-\infty}^{x\beta} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}t^2} dt \tag{2}$$

Or simply $Pr(Y = 1|X_1) = \Phi_{x_1\beta} \tag{2a}$

where $Pr =$ Probability parameter

$x_1\beta = \beta x_1 =$ independent variables and beta coefficients

$Pr(Y = 1|X_1) =$ probability of being vulnerable to economic shock

$\Phi =$ cumulative normal distribution function ($0 \leq \Phi \leq 1$)

Equation (2a) could be expressed to reflect multiple independent variables reflecting the various sub-sectors and sectors tested in this study by expanding the second part of the equation as follows:

$$Pr(Y = 1|X_1) = \Phi (\beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 \dots \dots \dots \beta_n x_n) + \varepsilon \tag{3}$$

where β_1 etc represents the coefficients

x_1 represents independent variables (economic sectors and sub-sectors)

$\varepsilon =$ the error term

To derive marginal effects of individual independent variables (a measure of “probability” of being vulnerable to economic shock), the full equation for the study is first specified. This is done by taking into

consideration the vulnerability to economic shock dichotomous dependent variable derived in equation 1, and the nine independent variables capturing selected sectors and sub-sectors of the US economy. The full equation is expressed as follows:

$$V_{s(i)(t)} = f(\beta_0 + \beta_1 X_{man} + \beta_2 X_{min} + \beta_3 X_{con} \dots \dots \dots + \beta_8 X_{fir} + \beta_9 X_{ser} + \varepsilon) \quad (4)$$

X_{man} , X_{min} , X_{con} etc represents selected sectors and sub-sectors of the US economy namely the manufacturing, Mining, Construction, Wholesale, Retail, Finance, insurance and real estates, transport, communication and utility sub-sectors and services and agriculture sectors of the economy respectively. Equation 4 states that the vulnerability of a sector or sub-sector to economic shock at time t is a function of its job creation growth rate.

From equation 2a, being vulnerable to economic shock is expressed as $Y=1$, and in equation one, ($V_{s(i)(t)}$) constitutes a measure of vulnerability to economic shock. Consequently vulnerability to economic shock could also be expressed as:

$$Y = 1 = V_{s(i)(t)} \quad (5)$$

Given equation 5, equation 2a could also be stated as follows:

$$\Pr (V_{s(i)(t)} = 1 | X_1) = \Phi_{x_i} \beta \quad (6)$$

Equation 6 states that the probability of being vulnerable to economic shock at time t , is a function of cumulative distribution function and specified independent variables.

Deriving Sub-Sector and Sector Vulnerability to Economic Shock

--Marginal Effects of Individual Sub-Sectors of the US Economy

Probit marginal effects of selected individual sectors and sub-sectors of the US economy provide a means of measuring ‘probability’ of being vulnerable to economic shock based on job creation growth rate characteristics. The following procedure derives marginal effects of selected sectors and sub-sectors of the US economy.

Recall equation (6) $\Pr (V_{s(i)(t)} = 1 | X_1) = \Phi_{x_i} \beta \quad (7)$

Where: $\Phi_{x_i} \beta = \Phi (\beta_0 + \beta_1 X_{ret} + \beta_2 X_{min} + \beta_3 X_{con} \dots \dots \dots + \beta_8 X_{fir} + \beta_9 X_{ser} + \varepsilon) \quad (8)$

Equation 7 could be transformed into a non-linear full model as:

$$\Pr (V_{s(i)(t)} = 1 | X_1) = \Phi (\beta_0 + \beta_1 X_{ret} + \beta_2 X_{min} + \beta_3 X_{con} \dots \dots \dots + \beta_8 X_{fir} + \beta_9 X_{ser} + \varepsilon) \quad (9)$$

Marginal effects of individual sub-sectors of the economy are derived using equation (2a) to first illustrate the process. Since equation (2a) is a non-linear function, marginal effect depends on the characteristics of x_i in $\Phi_{x_i} \beta$ (the independent variable) and differs among individual independent variables in the equation. A partial derivative of equation (2a) with respect to x_i is given as:

$$\frac{\delta \Pr (Y=1 | X_1)}{\delta x_i} = \Phi'(x'_i \beta) \beta \quad (10)^3$$

Following the chain rule procedure in equation 10, marginal effects of individual explanatory variables in equation (9) are derived. Marginal effect of the construction sub-sector of the economy (X_{con}), for instance can be derived as follows:

$$\frac{\delta \Pr (V_{s(t)} = 1 | X_1)}{\delta X_{con}} = \Phi'(x'_1 \Omega) \beta \quad (11)$$

Probit marginal effects for the rest of the explanatory variables are derived using similar procedure in equation 11.

Data and Test Variables

Data for this study is made up of job creation growth rate for seven sub-sectors and two sectors of the US economy. The data span the period 1977 to 2005. Data is tested for unit root to prevent the possibility of spurious regression results. Dependent variable is constructed as a dichotomous variable of being vulnerable to economic shock (1) or otherwise (0). Independent variables reflect job creation growth rate associated with selected sectors and sub-sectors of the US economic discussed above. The following table (table 1) and figure (figure 6.1) presents Probit and marginal effect Probit results measuring propensity to succumb to economic shocks features characterizing selected sectors and sub-sectors of the US economy.

EMPIRICAL RESULTS

Vulnerability to Macroeconomic Shock Features of the Explanatory Variables

Table 1 presents results of Probit and Marginal effects coefficients of selected sectors and sub-sectors of the US economy. The results show that with the exception of the services sector as a whole, the finance, insurance and real estate and construction sub-sectors which exhibits positive marginal effect coefficient, all other variables in the study recorded negative coefficients. Table 1 indicates a percentage growth in job creation rate in the mining sub-sector decreases the probability of being vulnerable to economic shock by 20% for firms engage in the sub-sector. Test result further show that for every percentage growth in job creation rate among firms in the manufacturing sub-sector, the probability of being vulnerable to economic shock decreases by 29.6%; the largest reduction in probability of being vulnerable to a shock characterizing a sub-sector in this study. For firms in the retail sub-sector, a percentage growth in job creation decreases the probability of being vulnerable to economic shock by 7.6%, the least decrease among the sub-sectors tested in this study.

A percentage growth in job creation in the agriculture sector as a whole is found to decrease the likelihood of being vulnerable to economic shock by 10.5% all things being equal. It is however important to point out that sub-sectors under the agriculture sector as a whole might exhibit varied resilience and capacity to cope features which might affect this vulnerability parameter. For instance, individual sub-sectors such as the meat and dairy production segment of the sector might not share this vulnerability to shock feature. Additionally, for every percentage growth in job creation in the Transport, communication and utilities sub-sector, the probability of being vulnerable to economic shock is decreased by 14.9%. Job creation growth rate associated with the construction sub-sector in this study was not significant in estimating the sub-sector's vulnerable to macroeconomic shocks. In the wholesale sub-sector however, results show a percentage growth in job creation tend to decrease the probability of being vulnerable to economic shock by 17% all things being equal. Job creation growth in the finance, insurance and real estate sub-sector is also significant in assessing the probability of being vulnerable to economic shock. However, the result indicates a percentage growth in job creation in the sub-sector all things being equal, rather increases the probability of being vulnerable to shock by 8.6%. This condition might stem from the fact that just a percentage growth in job creation among firms in the sub-sector is not enough to significantly strengthen the sub-sector against economic shock.

TABLE 1
MARGINAL EFFECT ON PROBABILITY OF BEING VULNERABLE TO
MACROECONOMIC SHOCK

Sector/Sub-Se	Probit	Marginal Effects
Mining	-0.62*** (0.08)	-0.200*** (0.02)
Manufacturing	-0.92*** (0.18)	-0.296*** (0.05)
Retail Services	-0.24* (0.11)	-0.076* (0.04)
Service	1.62*** (0.25)	0.519*** (0.07)
Agriculture	-0.33*** (0.06)	-0.105*** (0.02)
Tran, Com & Pu	-0.47*** (0.09)	-0.149*** (0.02)
Construction	0.03 (0.04)	0.012 (0.02)
Wholesale Serv	-0.44*** (0.11)	-0.173*** (0.04)
Fin, Ins & Real	0.22*** (0.05)	0.086*** (0.02)
_cons	13.73** (2.07)	4.58** (0.42)
Prob > chi2	0.000	0.000
Pseudo R ²	0.4273	0.4272

Standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

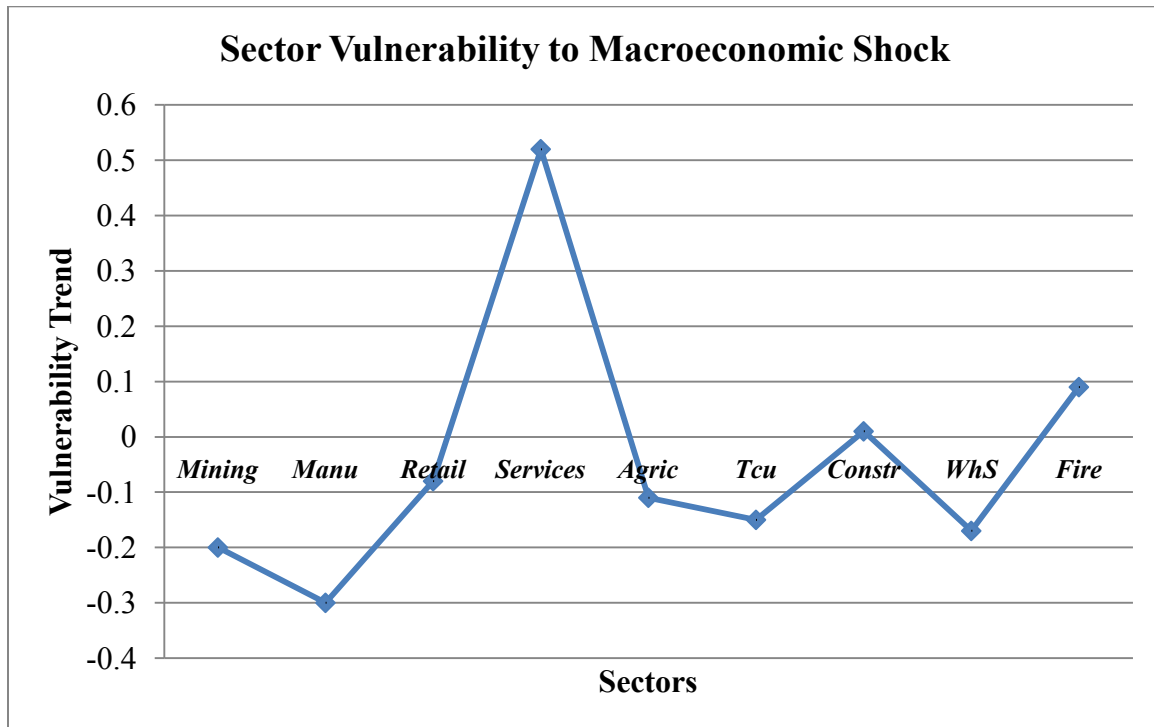
NB: Data replication procedure is used to achieve higher degree of freedom

Additionally, marginal effect outcome further show that just a percentage growth in the service sector as a whole is also not enough to reduce the sector's vulnerability to economic shock. Coefficient parameter indicates a percentage growth in job creation rather increases the probability of being vulnerable to shocks in the sector- positive coefficient. Again, this outcome could also be explained by a condition where job creation growth rate among firms in the sector explains less of the variation in the sector's vulnerability to economic shock. Although the retail sub-sector is associated with decreasing probability of being vulnerable to economic shock, comparatively, it has the least diminishing probability of being vulnerable to economic shock. A shock to the US economy all things being equal might impact the sub-sector more than other sub-sectors with negative coefficients captured in this study.

The most significant result is found among firms in the manufacturing sub-sector of the US economy. Ordinarily, the average American tend to espouse the notion that the manufacturing sub-sector tend to be more susceptible to economic downturn brought about by shocks. However, marginal effect analyses show that the sub-sector is characterized by the highest decreasing probability of being vulnerable to economic shock (-29.6%). In other words, the sub-sector is characterized by the least probability of being vulnerable to economic shock. Compared to other sub-sectors of the economy, this outcome sound somehow counterintuitive and highly incompatible with popular believes. However, it is important to point out that the condition being measured in this study is 'the probability of being vulnerable to economic shock' which is not the same as being vulnerable to economic shock. For instance, sub-sector

'A' might be characterized by a high probability of being vulnerable to economic shock, but that does not necessarily mean sub-sector 'A' is vulnerable to economic shock. The condition being measured is 'the probability of an occurrence' and not the occurrence itself; in this case, the probability of being vulnerable to economic shock and not vulnerability to economic shock. Figure 6.1 graphically illustrates probability of being vulnerability to economic shock features characterizing selected sectors and sub-sectors of the US economy.

FIGURE 6.1
SECTOR VULNERABILITY TO MACROECONOMIC SHOCK



CONCLUSION

This study has shown that job creation growth rate features associated with selected sectors and sub-sectors of the US economy influence how susceptible they are or will be to economic shock. The study finds that just like growth rate characteristics, sectors and sub-sectors of the US economy exhibit different probabilities of being vulnerable to economic shocks. A percentage growth in job creation growth rate among some sectors and sub-sectors of the economy is found to decrease (increase) the probability of being vulnerable to economic shock all things being equal.

The probability of being vulnerability to economic shock features exhibited by sectors and sub-sectors of the economy could play a significant role in economic policy effectiveness. The knowledge base could for instance aid in efficient allocation of scarce resources to specific sectors and sub-sectors of the economy deemed highly susceptible to economic shock. This will help strengthen productive capacities and the ability to cope during economic shock for targeted sectors, thereby boosting the prospect of achieving projected economic goals. For managers of firms in specific sub-sectors of the economy, the knowledge base could help in the development and implementation of strategic moves geared towards enhancing firm's resilience and capacity to thrive during economic shocks.

ENDNOTES

Title Economic shock in this study refers to any drastic changes in the economy (both supply and demand side shock) which negatively impact productive and job creation capacities of sectors and sub-sectors of the US economy.

2 (Sector's) insert in Moser's two dimensions to vulnerability figure above, is the researcher's personal addition to reflect the study's focus on a sector's level of vulnerability to economic shock.

3 Partial derivative result in equation (10) is obtained by applying the chain rule. The first term in equation (10) is the derivative of the cumulative distributive frequency (CDF) with respect to its argument, and the second term is the derivative of the argument with respect to the variable of interest (the independent variable).

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