Considering two important issues, (1) limited availability of data at the province level that goes back 30 years, and (2) the presence of several structural breaks in Indonesia‟s political economic history, we used quarterly (instead of yearly) data, for a period of 11 years (2000 until 2011). This provides us with 44 data points (quarters) for each indicator.

Since the data was only available on a yearly basis (11 data points for each indicator), we converted the yearly data into quarterly data. The method of conversion from yearly to quarterly data was (1) “Quadratic Match Sum” for the change in GRDP, (2) “Quadratic Match Average” for change in the contribution of the secondary sector to GRDP, (3) “Quadratic Match Average” for the total number of unemployed and underemployed labour force in East Nusa Tenggara, and (4) “Quadratic Match Sum” for manufacturing sector productivity in North Maluku. All variables used in empirical estimations were subjected to statistical checks and stationarity tests.

In terms of the structural breakdown of GRDP, the data shows that East Nusa Tenggara‟s economic structure between 2000 and 2011 has changed to some extent with a steady increase in the proportion of the tertiary sector in the GRDP, and a steady decline in the proportion of the primary sector. The secondary sector (SECSEC), however, remained stagnant in terms of percentage contribution to GRDP. In the first quarter of 2000, manufacturing contributed to about 10.1% of East Nusa Tenggara‟s GRDP. In the fourth quarter of 2011, however, its contribution has declined slightly to 8.9%.

As for North Maluku, the data shows a similarity in terms of how the proportion of secondary sector in the provincial GRDP has remained unchanged between 2000 and 2011. Each of the primary and tertiary sectors still formed around 40%-42% of the province‟s GRDP in 2011, comparable to their contributions in 2000. Meanwhile, manufacturing activities or the secondary sector still made up around 16%-17% of North Maluku‟s GRDP in 2011, similar to the proportion in 2000.

In terms of labour force utilisation, the data shows that the total number of unemployed and underemployed labour force in East Nusa Tenggara (UNDEMP) has fluctuated over a period of 11 years. For example, there were more unemployed and underemployed people in 2005 and 2009 compared to other years, reaching a peak of around 1.2 million people in 2005 and a low of 907,000 people in 2001. However, across the 11 years period there is an overall growing trend in the number of underutilised labour force in East Nusa Tenggara‟s economy.

Meanwhile, for North Maluku it can be noted that there was an increase in manufacturing sector productivity (PROMAN) from the first quarter of 2000 to the fourth quarter of 2011. Although manufacturing productivity had fluctuated, output per worker rose from 4.02 million to 8.74 million Rupiah between 2000 and 2011, in 2000 constant price. This is an increase in productivity of about 117% in over 11 years, which is quite substantial. However, considering that North Maluku was ranked 24th out of 33 provinces in manufacturing sector productivity in 2011, further improvements are needed to catch up with other parts of Indonesia.

4. Empirical Results

4.1 East Nusa Tenggara

The Geweke analysis is conducted in both bi-variate and multi-variate approaches. In the bi-variate analysis, correlation between the dependent variable (X) and independent variables (Y1 and Y2) were tested separately. This means that Geweke tests were conducted between X and Y1 as well as between X and Y2, checking the extent of correlation in both directions (X to Y and Y to X).

Through the bi-variate analysis, first we discuss the correlation between the change in economic output (GRDP) and contribution of the secondary sector in the provincial economy (SECSEC) of East Nusa Tenggara.

Table 2 shows a significant total correlation between GRDP and SECSEC in either direction ($F_{x,y}$ is significant at 1% level for both directions). Most of the correlation takes place instantaneously between GRDP and SECSEC ($F_{x\cdot y}$ is significant at 1% level for both directions). When looking at each direction, we find there were no significant correlation for both $F_{x\to y}$ and $F_{y\to x}$ when SECSEC was considered as X and GRDP was considered as Y (second row). However, we do find a notable correlation (up to 1% level of significance) for $F_{y\to x}$ when GRDP was considered as X and SECSEC as Y (first row). These suggest that GRDP and SECSEC are significantly correlated, with most of the correlation taking place instantaneously between the two variables. However, there is also a possibility that a causal mechanism is taking place from SECSEC towards GRDP.

Table 2. Estimated measures of bi-directional feedback Change of Economic Output (GRDP), Percentage of Secondary Sector in GRDP (SECSEC), and Number of Unemployed and Underemployed Labour Force (UNDEMP) for East Nusa Tenggara, Indonesia, 2000-2011[a]

Economic aggregates		$H_0(F_{x,y} = F_{x\to y} + F_{y\to x} + F_{x\cdot y})$			
x	y	$F_{x,y}$	$F_{x\to y}$	$F_{y\to x}$	$F_{x\cdot y}$
GRDP	SECSEC	1.5640 *** (0.0000)	0.0122 (0.4592)	0.2073*** (0.0023)	1.3445*** (0.0000)
SECSEC	GRDP	1.3606*** (0.0000)	0.0094 (0.5158)	0.0068 (0.5813)	1.3445 *** (0.0000)
GRDP	UNDEMP	1.4365*** (0.0000)	0.1038 (0.1073)	0.2048** (0.0122)	1.1278*** (0.0000)
UNDEMP	GRDP	1.3257 *** (0.0000)	0.1893** (0.0171)	0.0085 (0.8325)	1.1278*** (0.0000)

[a] *, ** and *** denote 10%, 5% and 1% level of significance, respectively.

Source: Authors

Next, we discuss the correlation between the change in GRDP and the total number of unemployed and underemployed persons in the province (UNDEMP). As also shown in

Table 2, we find a significant total correlation between GRDP and UNDEMP in either direction ($F_{x,y}$ is significant at 1% level for both directions). Most of the correlation takes place instantaneously between GRDP and UNDEMP ($F_{x\cdot y}$ is significant at 1% level for both directions). Looking at each direction, we find no significant correlation for $F_{x\to y}$ when GRDP was considered as X and UNDEMP was considered as Y. We also find no significant correlation for $F_{y\to x}$ when UNDEMP was considered as X and GRDP was considered as Y. These seem to suggest that there is no or very small likelihood of causal mechanism going from GRDP to UNDEMP. We do, however, found a significant correlation (up to 5% level of significance) for $F_{y\to x}$ when GRDP was considered as X and UNDEMP as Y. A similarly significant correlation (up to 5% level of significance) was also found for $F_{x\to y}$ when UNDEMP was considered as X and GRDP was considered as Y. These seem to suggest that there is a possibility of causal mechanism going from UNDEMP to GRDP.

In the multi-variate analysis, both the independent variables (Y1 and Y2, or EMP and ELEC) are aggregated (as Y) and its correlation with the dependent variable (X, or GDP) is tested. The multi-variate results are presented in Table 3. Table 3 shows that when SECSEC and UNDEMP were combined, we find a significant total correlation between X (GRDP) and Y (aggregate of SECSEC and UNDEMP) at the 1% level of significance. Most or 84% of that association (1.9812 over 2.3500) takes place instantaneously. We also found a significant correlation at the 5% level of significance which takes place from Y going towards X that accounts for about 10% (0.2446 over 2.3500) of the total correlation. The correlation going from X towards Y is not significant.

Table 3. Estimated measures of multi-directional feedback between Change of Economic Output (GRDP), Percentage of Secondary Sector in GRDP (SECSEC), and Number of Unemployed and Underemployed Labour Force (UNDEMP) for East Nusa Tenggara, Indonesia, 2000-2011[a]

Economic aggregates		$H_0(F_{x,y} = F_{x\to y} + F_{y\to x} + F_{x\cdot y})$			
x	y	$F_{x,y}$	$F_{x\to y}$	$F_{y\to x}$	$F_{x\cdot y}$
GRDP	SECSEC UNDEMP	2.3500 *** (0.0000)	0.1242 (0. 2543)	0. 2446** (0. 0326)	1.9812*** (0.0000)

[a] *, ** and *** denote 10%, 5% and 1% level of significance, respectively.

Source: Authors

These findings suggest in the case of East Nusa Tenggara, both the secondary sector's contribution to GRDP and size of unemployment and underemployment contribute to the change in overall provincial GRDP, but not the other way around. While instantaneous correlation between the dependent and independent variables are found, we also found correlation going from the independent variables (SECSEC and UNDEMP) towards the dependent variable (GRDP). The direction of causality is not two-way, as we did not find a significant correlation going from the dependent variable towards the independent variables.

4.2 North Maluku

The Geweke causality analysis for North Maluku was also conducted in both bi-variate and multi-variate models, as for East Nusa Tenggara above.

Consistent with the main variable of interest, first through the bi-variate analysis we discuss the correlation between the change in economic output (GRDP) and the contribution of the secondary sector in the provincial economy (SECSEC). Table 4 shows a significant total correlation between GRDP and SECSEC in either direction ($F_{x,y}$ is significant at 5% level when GRDP was considered as X, and 10% when SECSEC was considered as X). Most of the correlation takes place instantaneously between GRDP and SECSEC ($F_{x\cdot y}$ is significant at 5% level for both directions). When looking at each direction, we find a notable correlation (up to 5% level of significance) for $F_{y\to x}$ when GRDP was considered as X and SECSEC as Y (first row). However, there were no significant correlation for both $F_{x\to y}$ and $F_{y\to x}$ when SECSEC was considered as X and GRDP was considered as Y (second row). Similar to the results for East Nusa Tenggara, these suggest that GRDP and SECSEC are significantly correlated, with most of the correlation taking place instantaneously between the two variables. There is also a possibility that a causal mechanism is taking place from SECSEC towards GRDP.

Table 4. Estimated measures of bi-directional feedback Change of Economic Output (GRDP), Percentage of Secondary Sector in GRDP (SECSEC), and Productivity of Manufacturing Sector (PROMAN) for North Maluku, Indonesia, 2000-2011[a]

Economic aggregates		$H_0(F_{x,y} = F_{x\to y} + F_{y\to x} + F_{x\cdot y})$			
x	y	$F_{x,y}$	$F_{x\to y}$	$F_{y\to x}$	$F_{x\cdot y}$
GRDP	SECSEC	0. 2258 ** (0.0173)	0.0079 (0.5522)	0.1076** (0.0278)	0.1103** (0.0259)
SECSEC	GRDP	0.1491* (0.0817)	0.0356 (0.2053)	0.0032 (0.7045)	0.1103** (0.0259)
GRDP	PROMAN	0.2175* (0.0959)	0.0209 (0.6378)	0.1387* (0.0507)	0.0579 (0.1147)
PROMAN	GRDP	0.2727** (0.0388)	0.1040 (0.1069)	0.1108* (0.0923)	0.0579 (0.1147)

[a] *, ** and *** denote 10%, 5% and 1% level of significance, respectively.

Source: Authors

Next, we discuss the correlation between the change in GRDP and the productivity of the manufacturing or secondary sector in the province (PROMAN). As also shown in Table 4, we find a significant total correlation between GRDP and PROMAN in either direction ($F_{x,y}$ is significant at 5% level when PROMAN was considered as X, and 10% when GRDP was considered as X). There is an ambiguous direction of the correlation, where we find a 10% level of significance for $F_{y\to x}$ when GRDP was considered as X (third row) and the same level of significance for $F_{y\to x}$ when PROMAN was considered as X (fourth row). Instantaneous correlation between GRDP and PROMAN ($F_{x\cdot y}$) is not significant.

Results of the multi-variate analysis for North Maluku are presented in Table 5. Here we see that when SECSEC and PROMAN were combined, there is a significant total correlation between X (GRDP) and Y (aggregate of SECSEC and PROMAN) at the 5% level of significance. About one third or 33.9% of that association (0.1518 over 0.4474) takes place instantaneously. We also found correlation at the 10% level of significance which takes place from Y going towards X. The correlation going from X towards Y, however, is not significant.

Table 5: Estimated measures of multi-directional feedback between Change of Economic Output (GRDP), Percentage of Secondary Sector in GRDP (SECSEC), and Productivity of Manufacturing Sector (PROMAN) for North Maluku, Indonesia, 2000-2011[a]

Economic aggregates		$H_0(F_{x,y} = F_{x\to y} + F_{y\to x} + F_{x\cdot y})$			
x	y	$F_{x,y}$	$F_{x\to y}$	$F_{y\to x}$	$F_{x\cdot y}$
GRDP	SECSEC PROMAN	0.4474** (0.0373)	0.1074 (0.3287)	0.1882* (0.0882)	0.1518** (0.0382)

[a] *, ** and *** denote 10%, 5% and 1% level of significance, respectively.

Source: Authors

These findings suggest that for North Maluku, both the secondary sector‟s contribution to GRDP and the secondary sector‟s labour productivity contribute to the change in overall provincial GRDP, but not the other way around. Instantaneous correlation between the dependent and independent variables are found, but we also found a notable correlation going from the independent variables (SECSEC and PROMAN) towards the dependent variable (GRDP). The direction of causality is likely not two-way, as we did not find correlation going from the dependent variable

towards the independent variables. These results for North Maluku seem consistent with the findings for East Nusa Tenggara, albeit with a smaller level of significance.

5. Conclusion and Policy Implications

Indonesia is working to revive its growth level which has declined since 2014. Considering the uneven spread of economic activities, it is critical to better comprehend the possible causes of slow growth in the country‟s less competitive regions. The call for more sub-national analyses is in-line with Indonesia‟s decentralization policy (Hill, 2014) and its more recent drive to re-strengthen the role of province as coordinator of local economic development (USAID, 2009), as noted in Law No.12 of 2008 on sub-national governments.

For this purpose, Geweke causality analyses were conducted on two Indonesian provinces to understand better the underlying explanations for negligible economic growth over time. The cases of North Maluku and East Nusa Tenggara indicate that deficiency of growth is strongly associated with a stagnant manufacturing sector and low labour productivity over a period of 44 quarters. Both provinces used the same economic structure variable (which was the percentage of manufacturing sector contribution to GRDP). Both also used a productivity-related variable, which was productivity of the manufacturing sector for North Maluku and the number of unemployed and underemployed workers for East Nusa Tenggara.

The first variable highlights the importance of manufacturing as a labour-intensive sector that can drive higher productivity in an agricultural-based economy. In line with the theories of sectoral shift, moving away from subsistence farming and increasing value-adding activities through manufacturing is important to boost both province‟s economy. Opportunities are abound to develop food processing industries based on the abundant plantation products in both provinces, as well as cattle in East Nusa Tenggara and fish in North Maluku. Infrastructure in the form of roads and ports, as well as a good business environment and local economic governance would help the rise of this sector.

East Nusa Tenggara‟s Geweke tests suggests that underutilisation of labour force is hampering the province‟s economic growth. We find that unemployment and underemployment may have led to lost opportunity for the province as well as the people. Therefore, the creation of full-time jobs is critical. Manufacturing provides opportunity to absorb a large number of labour force, but the workers need to be prepared, for example through vocational education and on-the-job trainings. In North Maluku we find the manufacturing sector is dominated by small cottage industries with low productivity. There is limited number of companies operating with substantial capital, and insufficient cold storage facilities, which is a critical issue for a maritime province. Much potential awaits to improve overall productivity through value-adding, but this requires substantial investment in infrastructure (e.g. roads, ports, and power), industrial facilities (e.g. cold storage), as well as labour force capacity (e.g. vocational skills).

Increasing manufacturing productivity does not mean neglecting agricultural productivity, which remains important for a large country like Indonesia (Tan, Merdikawati, Amri, & Tan, 2015). Maluku and North Maluku have been identified in the national economic master plan (MP3EI) as the nation‟s primary fish source and reservoir, while East Nusa Tenggara has been designated as an important animal husbandry and fishery activity node (Coordinating Ministry for Economic Affairs, 2011). For provinces with large production potential in agriculture products, cattle, and fishery, the productivity of East Nusa Tenggara and North Maluku‟s manufacturing sector would benefit from the productivity of its primary sector. This is in-line with the argument that growth in agriculture is complementary to growth in manufacturing (de Souza, 2015) as low primary sector output leads to limited input for subsequent processing activities. Therefore, the strategy would be to improve the productivity of the secondary and primary sectors simultaneously. Increasing productivity can be achieved through upgrading local the Small and Medium Enterprises (SMEs) and attracting potential investors with higher capacity and more capital to partner with the SMEs and improve the latter‟s productivity and income (Blomstrom & Sjoholm, 1999; Hamidi, 2014). Another way to boost industrialisation is to boost trade - both strategies has been shown to correlate with each other and with economic growth (Dodzin & Vamvakidis, 2004; Park, 2011).

The objective of this research is to contribute to the literature on slow or lack of growth in the less competitive provinces of an emerging market economy, which has been found wanting. It also intends to add value to the more general literature through a time-series analysis on economic growth, industrialisation, and labour productivity. The analysis, however, faced some challenges in terms of quality and availability of data. Lack of sufficient data points originating from formal sources led to the interpolation of yearly data into quarterly data, which perhaps affected the quality of the analysis. Furthermore, focusing on a time series of a small number of variables may have created an omitted variable bias. Further research on the issues explored in this paper would benefit greatly from a more consistent and frequent tracking of the relevant data by officials.

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Appendix: The Methodology of Geweke Causality Analysis

Distribution of Statistics

Under the null hypothesis that there is no unidirectional causality running from Y to X:

$$\text{i.e. if } F_{Y\to X} = 0, \text{ then } n\,\hat{F}_{Y\to X} \sim \chi^2(klp) \tag{A1}$$

$$\text{If } F_{X\to Y} = 0, \text{ then } n\,\hat{F}_{X\to Y} \sim \chi^2(klp) \tag{A2}$$

$$\text{If } F_{X\cdot Y} = 0, \text{ then } n\,\hat{F}_{X\cdot Y} \sim \chi^2(kl) \tag{A3}$$

Since these tests are tests of nested hypotheses, $\hat{F}_{Y\to X}$, $\hat{F}_{X\to Y}$, and $\hat{F}_{X\cdot Y}$ are asymptotically independent. The measure of linear feedback between X and Y,$F_{X,Y}$, can be tested at once:

If $F_{X,Y}=0$.

$$n\,\hat{F}_{X,Y}\sim\chi^2(kl(2p+1)) \tag{A4}$$

Confidence Interval

The 95 percent confidence interval (CI) could be calculated approximately as follows:

For $\hat{F}_{Y\to X}$,

$$\left\{\left[\left(\hat{F}_{Y\to X}-\frac{klp-1}{3n}\right)^{1/2}-\frac{1.96}{\sqrt{n}}\right]^2-\frac{2klp+1}{3n},\left[\left(\hat{F}_{Y\to X}-\frac{klp-1}{3n}\right)^{1/2}+\frac{1.96}{\sqrt{n}}\right]^2-\frac{2klp+1}{3n}\right\} \tag{A5}$$

For $\hat{F}_{X\to Y}$,

$$\left\{\left[\left(\hat{F}_{X\to Y}-\frac{klp-1}{3n}\right)^{1/2}-\frac{1.96}{\sqrt{n}}\right]^2-\frac{2klp+1}{3n},\left[\left(\hat{F}_{X\to Y}-\frac{klp-1}{3n}\right)^{1/2}+\frac{1.96}{\sqrt{n}}\right]^2-\frac{2klp+1}{3n}\right\} \tag{A6}$$

For $\hat{F}_{X\cdot Y}$,

$$\left\{\left[\left(\hat{F}_{X\cdot Y}-\frac{kl-1}{3n}\right)^{1/2}-\frac{1.96}{\sqrt{n}}\right]^2-\frac{2kl+1}{3n},\left[\left(\hat{F}_{X\cdot Y}-\frac{kl-1}{3n}\right)^{1/2}+\frac{1.96}{\sqrt{n}}\right]^2-\frac{2kl+1}{3n}\right\} \tag{A7}$$

For $\hat{F}_{X,Y}$,

$$\left\{\left[\left(\hat{F}_{X,Y}-\frac{kl(2p+1)-1}{3n}\right)^{\frac{1}{2}}-\frac{1.96}{\sqrt{n}}\right]^2-\frac{2kl(2p+1)+1}{3n},\left[\left(\hat{F}_{X\cdot Y}-\frac{kl(2p+1)-1}{3n}\right)^{\frac{1}{2}}+\frac{1.96}{\sqrt{n}}\right]^2-\frac{2kl(2p+1)+1}{3n}\right\} \tag{A8}$$