Adding Economic Life Cycle Accounting to Open Checkbooks

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July 24, 2018

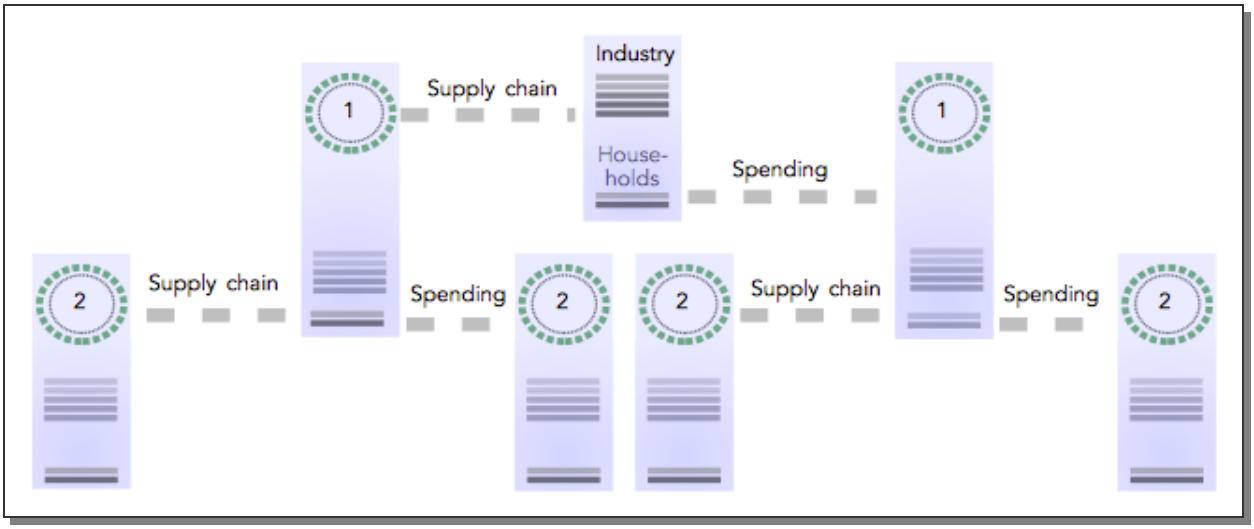
Economic life cycle accounting plays a vital role in good government, starting with multi-criteria planning to support sustainable development to transparency and assurance in the reporting of economic impacts related to government investments and expenditures. In this paper, I discuss how government finance and technology professionals can take advantage of open data initiatives and economic life cycle accounting tools to measure and report on their contribution to the local economy.

What is economic life cycle accounting?

For any economic activity, life cycle accounting is the tracing of production back through the supply chain and forward through the spending of income using double entry bookkeeping, where the double entries are demand and supply instead of debits and credits. Compared to financial accounting, which concerns itself with either demand or supply side entries for an economic activity, economic bookkeeping is the simultaneous accounting of demand and supply, producing a balanced system of production and income transactions within a national, regional, or local economy.

Figure 1 illustrates the concept of economic life cycle accounting through the first two cycles. Just like environmental life cycle assessment, economic life cycle accounting systems produce a complete accounting of the impact of an economic activity from the initial material inputs and intermediate goods to the final demand for the product. Through the production life cycle back through the supply chain and forward through the spending of income, the initial economic activity multiplies more or less depending upon how much of the resulting economic activity takes place in the geographic area of interest. By keeping track of these connections, economic life cycle accounting tallies up the total value added within an economic system that results from a single economic activity.

Figure 1: Economic life cycle accounting illustration



Why implement economic accounting with open checkbooks?

Economic life cycle accounting applies directly to government purchasing processes, as it records the invisible impacts back through the supply chain. Local taxes that result in local projects and expenditures add to the development of the local economy, creating on-going rounds of locally generated demand and supply. Without an economic accounting system, these benefits are invisible to decision-makers and citizens.

Implementing economic life cycle accounting is straightforward and requires little in time or money to get started, leveraging the trend towards financial transparency and open data in government. In the rest of this article, I illustrate just how simple it is to implement economic life cycle accounting for government expenditures using financial data published in Ohio's open checkbook at local.ohiocheckbook.com.

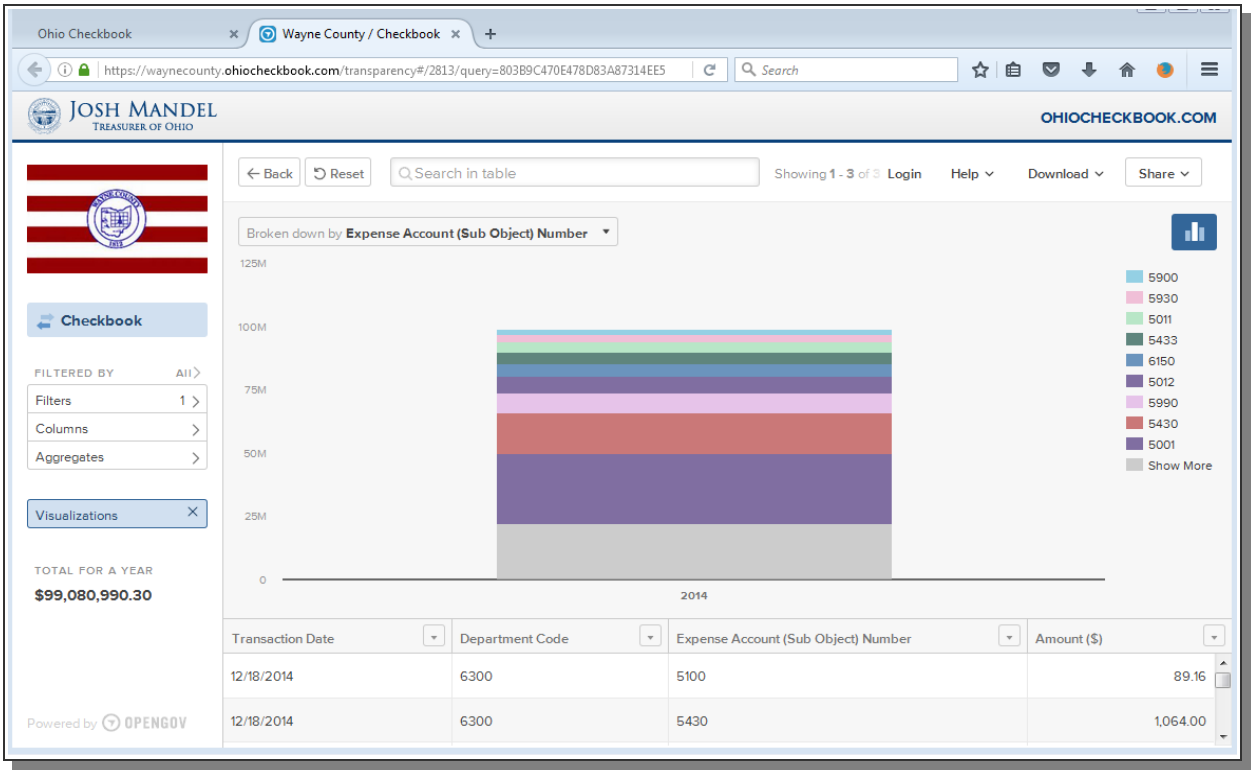
Open checkbook example

For this example, I am using the expenditure file for Wayne County, Ohio in 2014. With the publishing of open checkbooks, I performed the economic accounting for this case without requiring any staff time from government employees.

Wayne County had a total of $99,080,990 expenditures in this open checkbook. To go from financial accounting to economic accounting, I built a bridge between the financial chart of accounts and the economic chart of accounts to recode the $99 million in financial expenditures by economic activity. For the financial side, I used the Expense

Account Number field and the Department Code field, allowing for special cases where the same expense account number may represent a different type of expenditure depending on the department. These special cases typically occur for account codes for contractors, projects, etc. in which the account code does not directly correlate with an industry's output. For example, project expenses for the engineering department are spent on different industries compared to project expenses for the job and family services department. For the economic side, I used the commodity codes as defined in the Bureau of Economic Analysis' Input-Output Tables. The commodity codes track the total economic life cycle associated with each expenditure by defining the inter-industry links between supply and demand in the economy.

Figure 2: Ohio's open checkbook - Wayne County transactions in 2014

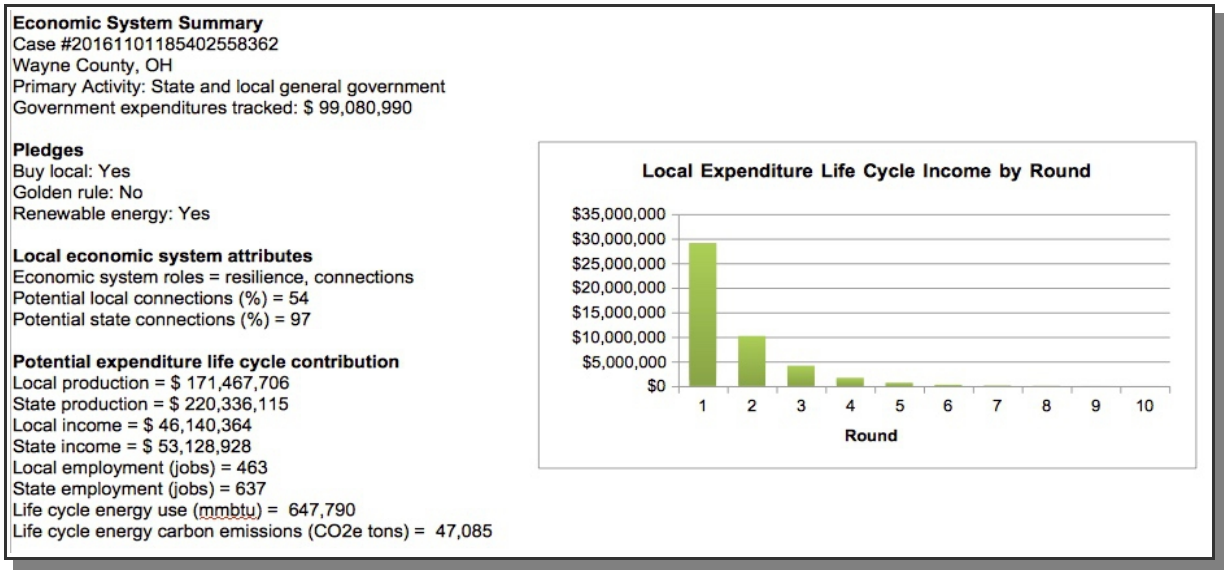


After recoding the expenditures from financial account codes into economic codes, I ran the expenditure file through an economic life cycle accounting system that traces demand/supply transactions back through the supply chain. The results represent pro forma statements of life cycle contribution to the local economy. The county could report

these contributions as a note in the Comprehensive Annual Financial Report, or as part of the county's annual sustainability report.

As shown on the statement in Figure 3, the $99 million in expenditures result in potential local economic production of $171 million in Wayne County and state production of $220 million in Ohio, which represent 54% and 97% respectively of the total life cycle production from the government's checkbook expenditures. The state production of $220 million includes the local Wayne County production of $171 million. This potential production results in $46 million in local income and $53 million in state income. The potential local production uses 648,000 million Btu of energy, resulting in about 47,000 tons of CO^2 emissions.

Figure 3: Wayne County, Ohio Expenditures 2014: Pro Forma Statement of Potential Economic System Contribution



This pro forma local production potential represents the upper limit based on local industry capacities. In other words, this life cycle accounting statement applies if Wayne County follows a "buy local" policy when making purchases. Economic life cycle accounting systems can implement different assumptions about local purchasing that will affect the projected level of contribution to the local economy. In this particular case, I used an accounting system that accounts for local buying preferences as indicated on the statement as a "Buy local" pledge. Pledges are a voluntary method for implementing sustainability initiatives, such as renewable energy generation and purchasing.

So, considering the statement in Figure 3 again, if Wayne County government prioritizes or requires local purchasing in its contracts and suppliers, and businesses down the supply chain prioritize locally as well, the local production of $171 million may be realized, which in turn will provide $46 million in local income. This result illustrates the dynamics of a local economic system in which a portion of the $99 million in government fees and taxes that are collected return to the local system, resulting in resident income of $46 million. The income chart on the statement shows how the initial expenditures in the first round create additional income back through the supply chain.

In addition to the aggregated total contribution, life cycle accounting provides detailed statements on contributions such as 1) employment by education, experience, and on-the-job training requirements, and 2) energy use and associated emissions by fuel. For example, a portion of the workforce employment statement is shown below in Figure 4. As listed on this portion of the statement, the life cycle employment contribution from the $99 million in government expenditures includes 78 jobs requiring a bachelor's degree and 246 jobs requiring a high school diploma. Of the 246 jobs requiring a high school diploma, 216 are entry-level positions requiring no experience, with some of these positions offering on-the-job training.

The energy use statement in Figure 5 reflects the electric generation fuel mix for Ohio of coal, nuclear, and natural gas; natural gas consumption for heating of buildings, and gasoline for operation of fleets. Additional detailed statements can be added for other criteria important for development of the local economy, such as contribution to local resilience capacity and to occupational variety, often important factors for sustaining populations in rural areas.

Figure 4: Pro Forma Statement of Potential Local and State Employment

	A	B	C	D
1	Life Cycle Workforce Employment Potential			
2				
3	Occupation Requirements (Education - Experience - OTJ Training)	Current Local Workforce	Local Life Cycle Employment Potential	State Life Cycle Employment Potential
9	**Associate's degree -- Total**	**1256**	**6.27**	**9.75**
20	**Bachelor's degree -- Total**	**5039**	**78.05**	**111.57**
26	**Doctoral or professional degree -- Total**	**708**	**4.11**	**4.87**
27	High school diploma or equivalent - 5 years or more - Long-term on-the-job training	1	0	0
28	High school diploma or equivalent - 5 years or more - Moderate-term on-the-job training	9	0.16	0.2
29	High school diploma or equivalent - 5 years or more - None	870	8.66	11.03
30	High school diploma or equivalent - Less than 5 years - Long-term on-the-job training	1	0.02	0.03
31	High school diploma or equivalent - Less than 5 years - Moderate-term on-the-job training	46	1.57	2.14
32	High school diploma or equivalent - Less than 5 years - None	1807	19.8	26.64
33	High school diploma or equivalent - Less than 5 years - Short-term on-the-job training	0	0	0
34	High school diploma or equivalent - None - Apprenticeship	672	17.03	19.07
35	High school diploma or equivalent - None - Long-term on-the-job training	2035	30.68	42.99
36	High school diploma or equivalent - None - Moderate-term on-the-job training	7239	84.86	122.08
37	High school diploma or equivalent - None - None	254	3.28	4.71
38	High school diploma or equivalent - None - Short-term on-the-job training	5300	79.87	109.17
39	**High school diploma or equivalent -- Total**	**18234**	**245.93**	**338.06**

DataDefinitions | LifeCycleIncome | LifeCycleOutput | IndustryOutput | **Workforce** | EnergyUse

Figure 5: Pro Forma Statement of Potential Energy Use and Associated Emissions

Life Cycle Energy Use and Associated Emissions

Fuel	Lifecycle Use (mmBtu)	Life Cycle Energy Emissions (lbs. CO2e)
coal	131,470	27,295,722
elec	36,585	0
fueloil	46,195	7,492,268
gasoline	218,931	34,398,520
jetfuel	13,200	2,103,048
lpg	23,256	3,254,966
natgas	167,104	19,598,999
nuclear	10,921	0
other	26	4,551
otherbio	65	14,445
othergas	0	60
wood	37	8,397

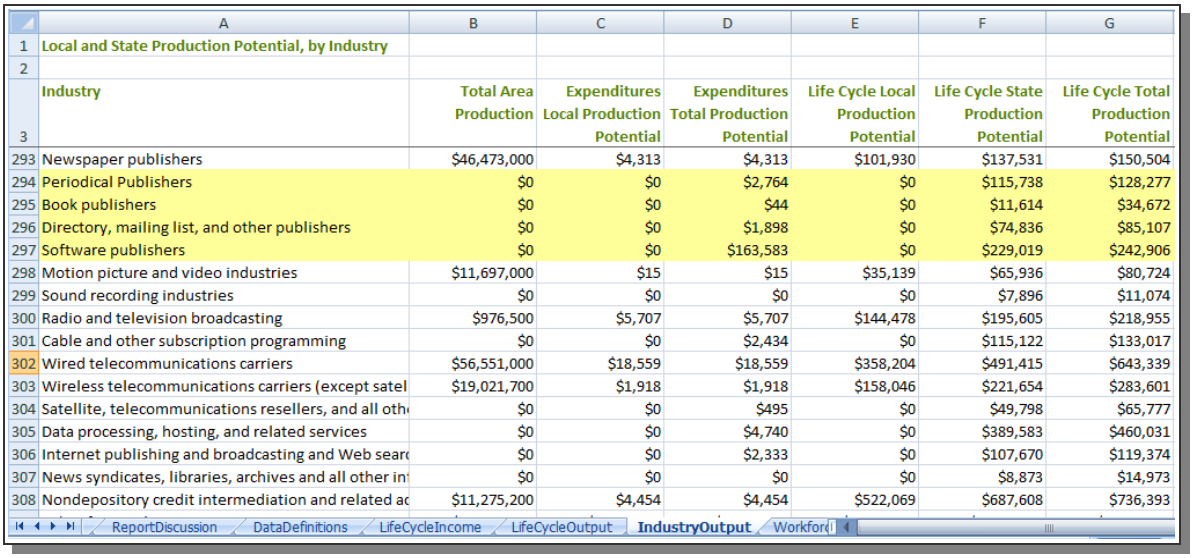
Performance improvement and auditing

These contribution statements represent the starting point for the performance improvement process. The Local and State Life Cycle Production Potential, by Industry statement, as shown in Figure 6, lists for each industry the local capacity and the local, state, and total production potentials linked to the county's expenditures. This pro forma accounting statement supports performance improvement and auditing in the following ways:

1. For direct connections between the government and a supplier, check the "Expenditure Local Production Potential" column on the IndustryOutput worksheet to see the pro forma local production based on current local capacities by industry. For industries in which Expenditure Local Production Potential is greater than zero, compare these values with actual local expenditures by querying the financial system using the zip code field to identify if suppliers are local. For example, in the figure below compare the pro forma direct expenditure value of $4,313 for Newspaper Publishers with actual expenditures for this economic activity. If the query of the financial system shows no payments to local newspaper publishers, initiate a purchasing task to qualify local publishers for future purchases.
2. In the case where local capacities do not exist, define economic development tasks to recruit businesses to locate operations in the county or recruit startup operations, using local demand as an incentive. These efforts will result in increased benefits over time as more local connections are established.

These tasks become an important part of the performance improvement process as well as serve as an auditing process to provide assurance that the pro forma statements are indicative of the actual contribution. For instance, if the Newspaper Publisher expenditure is assumed to be local on the pro forma statement but the query of the financial system shows no payments to local newspaper publishers, then for this line item the local contribution is overstated. This overstatement, in turn, will result in overstatement of contribution on other line items back through the supply chain for newspaper publishers. It is this process that really illustrates how much governments can affect their own local economy through their purchasing process.

Figure 6: Pro Forma Statement of Local and State Life Cycle Production Potential, by Industry



	A	B	C	D	E	F	G
1	Local and State Production Potential, by Industry						
2							
3	Industry	Total Area Production	Expenditures Local Production Potential	Expenditures Total Production Potential	Life Cycle Local Production Potential	Life Cycle State Production Potential	Life Cycle Total Production Potential
293	Newspaper publishers	$46,473,000	$4,313	$4,313	$101,930	$137,531	$150,504
294	Periodical Publishers	$0	$0	$2,764	$0	$115,738	$128,277
295	Book publishers	$0	$0	$44	$0	$11,614	$34,672
296	Directory, mailing list, and other publishers	$0	$0	$1,898	$0	$74,836	$85,107
297	Software publishers	$0	$0	$163,583	$0	$229,019	$242,906
298	Motion picture and video industries	$11,697,000	$15	$15	$35,139	$65,936	$80,724
299	Sound recording industries	$0	$0	$0	$0	$7,896	$11,074
300	Radio and television broadcasting	$976,500	$5,707	$5,707	$144,478	$195,605	$218,955
301	Cable and other subscription programming	$0	$0	$2,434	$0	$115,122	$133,017
302	Wired telecommunications carriers	$56,551,000	$18,559	$18,559	$358,204	$491,415	$643,339
303	Wireless telecommunications carriers (except satel	$19,021,700	$1,918	$1,918	$158,046	$221,654	$283,601
304	Satellite, telecommunications resellers, and all oth	$0	$0	$495	$0	$49,798	$65,777
305	Data processing, hosting, and related services	$0	$0	$4,740	$0	$389,583	$460,031
306	Internet publishing and broadcasting and Web sear	$0	$0	$2,333	$0	$107,670	$119,374
307	News syndicates, libraries, archives and all other in	$0	$0	$0	$0	$8,873	$14,973
308	Nondepository credit intermediation and related ac	$11,275,200	$4,454	$4,454	$522,069	$687,608	$736,393

ReportDiscussion | DataDefinitions | LifeCycleIncome | LifeCycleOutput | IndustryOutput | Workforc

Implementing the technology

As the example in this paper demonstrates, implementing economic life cycle accounting consists of a few straightforward steps:

- Using the financial accounting system as the base, add economic account codes to transactions.
- Process the transactions through an economic life cycle accounting system to simulate all of the demand/supply transactions back through the supply chain.
- Use the economic accounting statements as part of the economic performance improvement process.
- Publish economic accounting statements in financial and sustainability reports to promote transparency and inform internal agencies and citizens.

Given this straightforward process, government finance and technology professionals have a couple of options for integrating the technology:

1. Integrate the economic chart of accounts with the financial accounting system and access the life cycle accounting system via an application programming interface (API). This option requires staff time, but gives the government entity

continuous reporting capabilities, which may desirable from a performance improvement standpoint.

2. Given the trend towards open financial data, hire an independent party to prepare economic accounting statements on an annual basis in conjunction with the preparation of the Comprehensive Annual Financial Report. This option requires no additional financial or technology staff time if the government opens its checkbook, since all required data are accessible through the published open data. Otherwise, some financial staff time may be required to transmit financial transactions for use by the independent party.

Implementing for accounting firms

Implementing the technology for accounting and auditing firms that serve as the independent party is straightforward as well. These firms' accountants build the bridge between financial and economic codes, and then access an economic life cycle accounting system via an API. For accounting firms, the economic accounting system serves a similar purpose as tax accounting software, where financial data are input and tax forms are output. In this case, financial data are input and economic accounting statements are output.