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The Conversion among the Price Systems: The Case from Supply-Use framework to Make-Use framework

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Abstract: IMPLAN's current U.S. model is based on the BEA's featured benchmark Input-Output accounts, which are compiled in the make-use framework. The make table shows the production of commodities by industries and the use table shows the uses of commodities by both industries and final users. The make and use tables are in producers' prices, which represent the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer.

Most international Input-Output accounts, however, are based on the supply-use framework. The supply and use tables offer a similar, but somewhat more detailed portrait of an economy, represented using a different pricing system. The supply table shows the supply of goods and services by product and by type of supplier, from both domestic and foreign producers. The use table shows the use of goods and services by product and by type of use, i.e., as intermediate use by industry and as final use, as well as value added by industry. The supply table is generally in basic prices including a transformation to purchasers' prices and the use table is typically in purchasers' prices, but sometimes is published in basic prices. The basic prices are the price receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, plus any subsidy receivable on that unit because of its production or sale. The purchasers' prices are the prices the purchaser pays for the products, including any taxes less subsides on the products, and any transport charges paid separately by the purchaser to take delivery. In its ideal form, the supply-use framework also contains several "valuation matrices" that show a detailed decomposition of wholesale and retail trade margins, transportation costs, and taxes on products net of subsidies.

In order to clarify the relationship between the make-use framework and the supply-use framework, we provide a detailed conversion process between the price systems. BEA (2015) has published a briefing of creating the supply-use tables from the make-use tables of U.S.; therefore, this paper

will only focus on the conversion from the supply-use framework to the make-use framework, which corresponds to a conversion from basic and/or purchasers' prices to producers' prices. We use Eurostat data for Austria in 2010 as the case, creating the make and use tables from the original supply table, use table, margin table and taxes on products less subsidies table.

This conversion method could provide a standard process for creating data in the make-use framework from any international data published in the supply-use framework, thereby facilitating inclusion of the data in IMPLAN software.

Key Words: Input-Output Table, Supply-Use Framework, Make-Use Framework

1. Introduction

The input-output (I-O) tables were first developed as a tool for economic analysis in 1930s by the Nobel laureate Wassily W. Leontief. I-O tables can and often do provide the framework for preparing the national and other economic accounts that are used for all kinds of analysis. Since 1947, when the first version of the System of National Accounts (SNA)[1] was prepared by the sub-committee on National Income Statistics of the League of Nations Committee of Statistical Experts under the leadership of Richard Stone, the I-O tables have become a primary component for producing national economic accounts. The I-O accounts focus on the inter-relationships between industries in an economy with respect to the production and uses of their products and the products imported from abroad. This accounting framework provides the basic information for estimating gross domestic product (GDP) and the detailed, balanced set of statistics on economic processes and relationships. The core of the I-O accounts consists of two basic national-accounting tables. According to the different I-O frameworks, the two basic national accounting tables could be the "make" table and "use" table (make-use framework), or the "supply" table and "use" table (supply-use framework).

The make-use framework (MUT framework) was first introduced in the 1968 version of the System National Accounts (1968 SNA). Since then, over half of the countries (including the

[1] The System of National Accounts (SNA) is under the joint responsibility of the United Nations, the International Monetary Fund, the Commission of European Communities, the Organization for Economic Co-operation and Development, and the World Bank.

The broad objective of the SNA is to provide a comprehensive conceptual and accounting framework for compiling and reporting macroeconomic statistics for analyzing and evaluating the performance of an economy. https://unstats.un.org/unsd/nationalaccount/hsna.asp

United States) have adopted the SNA make-use framework of input-output models. The 1972 Benchmark I-O tables of the United States (published in 1979) were the first prepared by the Bureau of Economic Analysis (BEA) that incorporated the make-use framework.

The supply-use framework (SUT framework) is similar to the make-use framework, which was introduced by the System National Accounts 2008 (2008 SNA). In 2011, Eurostat published for the first time a consolidated annual supply-use framework and derived input-output tables for the European Union and the Euro Area.[2] Since 2015, the BEA has also begun to release the U.S. supply-use tables annually.

The supply-use framework has generated great attention in recent years, especially for its applicability to analyze the globalization of economic activities, however, the make-use framework is more descriptive of the real-world economy. For example, in addition to the production and the utilization of the primary products, the secondary products by industries are also presented in the make-use framework, which is significant for comprehensive real-world economic impact analysis. Therefore, each of these frameworks has its own advantages in analyzing economic impacts.

The main objective of this paper is to provide a detailed conversion process between the make-use framework and the supply-use framework. BEA (2015) has published a briefing of creating the supply-use tables from the make-use tables of U.S.; therefore, this paper will only focus on the conversion from the supply-use framework to the make-use framework, which corresponds to a conversion from basic and/or purchasers' prices to producers' prices. Moreover, IMPLAN's current main products are the U.S. I-O models at all different geographical levels. Since all the U.S. I-O models are generated based on the BEA's benchmark make-use I-O models, the current IMPLAN software platform is more compatible with the make-use I-O framework. This conversion method could provide a standard process for the creation of data in the make-use framework from any international data published in the supply-use framework, thereby facilitating inclusion of the data in IMPLAN software.[3]

2. The linkage among the price systems

2.1. The Supply-Use Framework (SUT)

The supply-use framework consists of two interlinked tables: the Supply table and the Use table. The two tables

[2] The Euro Area consists of those European Union (EU) member states which have adopted the Euro as their single currency.

[3] IMPLAN also plans to explore options to make its software more compatible with the supply-use framework.

have identical industries (columns) and products (rows). [4]

Table 1 shows the basic structure of the supply table. The components of this table are domestic output at basic prices, imports, trade margins and transportation costs, and taxes on products and subsidies on products. Domestic output is the value of goods and services produced within a given economy over a year. Imports consist of purchases of goods and services by residents and local businesses from non-resident producers/suppliers. [5] The domestic supply by commodity is the sum of the domestic output and imports, which is valued at basic prices. It also includes the valuation adjustment matrix as the transformation to purchasers' prices. The valuation adjustment matrix includes the trade margins and transportation costs paid on each product, and the taxes on each product and the subsidies on each product. Trade margins are actual revenues realized on goods purchased for resale minus the cost of the purchased products for trade. The transportation costs are the separate payments for transport services of goods. The column totals in this table represent industry's total supply, while the row totals represent total supply of the respective product.

Table 1. The structure of the Supply Table (SUT)

Supply Table (SUT)		Industries			Total Commodity Output (Basic prices)	Imports	Total Commodity Supply (Basic prices)	Valuation Adjustment				Total Commodity Supply (Purchasers' prices)
		Industry 1	...	Industry n				Trade Margins	Transportation Costs	Taxes on products	Subsidies on Products	
Commodities	Commodity 1											
	...											
	Commodity m											
Total Supply (Basic prices)												

Table 2 shows the structure of the use table (SUT). The components of this table are intermediate consumption, final demand and value added. Intermediate consumption is the value of goods and services used in the production process. The final demand section includes final consumption expenditure, gross capital formation and exports. Final consumption expenditure column is the summation of the household final consumption expenditure and government final consumption expenditure, and the non-profit organizations serving households (NPISH) final consumption expenditure. The gross capital formation column is the summation of gross fixed capital formation and changes in inventories. Exports consist of purchases of goods

[4] Products and Commodities are used interchangeably in this paper.

[5] Imports are generally valued at the CIF, also known as importers' customs frontier price.

and services by non-residents from resident producers/suppliers. It further shows the components of value added by industry, namely compensation of employees, other taxes on production, and gross operation surplus. The summation of these three components is the value added at basic prices. By adding total intermediate inputs and value added at basic prices, the column totals will be represented as the total industry output at basic prices. By including the net taxes, value added at basic prices will be transformed into value added at purchasers' prices. The row totals of this table represent the total uses by product, while the column totals represent the total input by industry, total final consumption, total gross capital formation, and total exports.

Table 2. The structure of the Use Table (SUT)

Use Table (SUT)		Industries			Total Intermediate Use (Purchasers' prices)	Final Demand (Purchasers' prices)			Total Use of Commodities (Purchasers' prices)
		Industry 1	...	Industry n		Final Consumption Expenditures	Gross Capital Formation	Exports of goods and services	
Commodities	Commodity 1								
	...								
	Commodity m								
Total Intermediate Inputs (Purchasers' prices)									
Compensation of employees *Other taxes on production* *Gross operation surplus*									
Value Added (Basic prices)									
Total Industry Output (Basic prices)									
Taxes on products and imports less Subsidies									
Value Added (Purchasers' prices)									

2.2. The Make-Use Framework (MUT)

The make-Use framework consists of two interlinked tables: the Make table and the Use table. The rows and columns of the make and use tables are reversed, but both tables are valued at the producers' prices.

Table 3 shows the structure of the make table (MUT). This is the simplest table in both frameworks and is the only one that has reversed the rows and columns. The rows are the industries, and the columns are the commodities. The main component of this table is the make matrix, which represents the commodities that are produced by the industries. The column totals represent total commodity output, while the row totals represent total industry output.

Table 3. The structure of the Make Table (MUT)

Make Table (MUT)		Commodities			Total Industry Output (Producers' prices)
		Commodity 1	…	Commodity m	
Industries	Industry 1				
	…				
	Industry n				
Total Commodity Output (Producers' prices)					

Table 4 shows the structure of the use table (MUT). This table is nearly identical to the featured use table in the SUT framework. Both show the use of commodities by industries and by final users as well as the value added by industry. The final uses in this table include the final consumption expenditures by household and government, gross capital formation, exports and imports. The imports column is one of the main differences between the two use tables. Furthermore, value added in this table includes three components, which are compensation of employees, taxes on production and imports less subsides, and gross operating surplus. The first two of these components are the same as in value added at basic prices, with the only different one being the taxes on production and imports less subsides, which is the difference between the basic prices and the producers' prices of value added. By adding total intermediate inputs and value added at producers' prices, the column totals is represented as the total industry output at producers' prices, while the row totals is represented as the total commodity output. Total value added is equal to total final uses, which is the value of GDP.

Table 4. The structure of the Use Table (MUT)

Use Table (MUT)		Industries			Total Intermediate Use (Producers' prices)	Final Demand (Producers' prices)					Total Use of Commodities (Producers' prices)
		Industry 1	...	Industry n		Final Consumption Expenditures	Gross Capital Formation	Exports of goods and services	Imports good and services	Total Final Uses (Producers' prices)	
Commodities	Commodity 1										
	...										
	Commodity m										
Total Intermediate Inputs (Producers' prices)											
Compensation of employees											
Taxes on production and imports, less subsidies											
Gross operation surplus											
Total Value Added (Producers' prices)											
Total Industry Output (Producers' prices)											

2.3. The linkage

Since the SUT framework and the MUT framework represent different price systems, the linkage between these two frameworks is basically the linkage among the prices systems as well. Basic, producers' and purchasers' prices are defined as follows (Eurostat, 2008):

- *Basic prices are the amount receivable by the producer from the purchaser for a unit of a good or service as output minus any tax payable, and plus any subsidy receivable by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer. Basic prices valuation is the most homogenous concept as trade margins, transportation costs as well as product taxes and subsides are eliminated.*
- *Producers' prices are the amount received by the producer from the purchaser for a unit of goods or services produced as output minus any VAT,* [6] *or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer.*
- *Purchasers' prices are the amount paid by the purchaser, excluding any VAT or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or a service at the time and place required by the purchaser. The purchasers' prices of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place.*

The difference between basic prices and producers' prices is the net taxes on products, which includes the taxes paid by the producers and the subsidies received by the producers. The differences between producers' prices and purchasers' prices include two parts. One part consists of trade margins and transportation costs, since these charges

[6] Value Added Tax (VAT) does not exist in every country. For example, U.S. has no VAT.

involved in distributing the products are paid by the purchasers. The other part is the non-deductible value added taxes, since this part of value added taxes could not be deducted from the purchasers' own VAT liability.

Figure 1 in the Appendix shows the detailed linkage between the SUT framework and the MUT framework and among the price systems. Three types of identities must hold between the two tables in either framework. From the industry side, the total supply by industries should be equal to the total output by industries. From the product side, the total use of products should be equal to the total supply of products. Finally, between the industry and product, the total industry supply (output) should be equal to the total use (supply) of products.

According to the linkage and the three identities, several equation balances must hold. These equations are important for calculating the total control values at producers' prices and checking the value consistency.[7]

- Total Industry Output (producers' prices) = Total Industry Output (purchasers' prices) – Total Margins (0)[8] = Total Intermediate Inputs (purchasers' prices) + Total Value Added (purchasers' prices)
- Total Intermediate Inputs (producers' prices) = Total Intermediate Inputs (purchasers' prices)
- Total Value Added (basic prices) = Compensation of Employees + Other taxes on production + Gross operation surplus
- Total Value Added (producers' prices) = Total Value Added (purchasers' prices) – Total Margins (0) = Total Value Added (basic prices) + Taxes on production less subsidies = Compensation of Employees + Taxes on production and imports less subsidies + Gross operation surplus
- Total Commodity Output (Producers' Prices) = Total Commodity Output (Basic Prices) + Taxes on Production less Subsidies

3. Conversion Example

The conversion example dataset is from EuroStat. We use Austria 2010 data as the case, to create the make and use tables from the original supply table and use table (at purchasers' prices).[9] The dataset consists of 65 products and 65 industries.[10]

Table 5 in the Appendix shows the supply table of Austria 2010. The total domestic commodity output at basic prices is 543,979 million euross. The imports total is 133,898 million euros,

[7] These equations should hold for each industry in the I/O framework.

[8] Total margins sum to zero.

[9] There are margins table and taxes less subsidies table as the supplementary.

[10] In this case, the MUT and SUT tables are squared. However, they are not required to be.

which makes the total domestic commodity supply 677,876 million euros. The valuation adjustment matrix bridges the difference between total commodity supply at basic prices and at purchasers' prices. The trade and transportation margins column are the summation of the trade margins and transportation costs of each product. The sum of this column is zero, which confirms that the margins rearrangement is not adding to or subtracting from the existing output. The taxes on products less subsidies column is the taxes on products minus the subsidies on product of each product. The total commodity supply at purchasers' prices is 710,192 million euros.

Table 6 in the Appendix shows the use table (at purchasers' prices) of Austria 2010.[11] The total intermediate use by industry is 281,663 million euros. The total final uses of final consumption, gross capital formation by household and by government, and exports are 223,859 million euros, 66,738 million euros, and 137,932 million euros, respectively. The value added section represents the income that is generated by production, including both valued added at basic prices and value added at purchasers' prices, which are 262,315 million euros and 294,632 million euros. The total industry output at basic prices is 543,979 million euros, while the total commodity use at purchasers' prices is 710,192 million euros.

The supply-use framework shows the equivalence of the supply and use at both basic prices and purchasers' prices. At basic prices, the total balance value is 543,979 million euros, while at purchasers' prices, the total balance value is 710,192 (total commodity supply) – 133,898 (imports) = 576,294 million euros. These values represent the balance of the total industry output (input) and the total commodity supply (use).

The conversion from supply-use framework to make-use framework includes several steps for the make table and the use table, separately.

The conversion process for the make table:

1. Calculate the total industry output at producers' prices (see the equation in section 2.3)
   Each industry's total output at producers' prices is equal to that industry's total output at purchasers' prices minus the total margins. The margins transformation is to adjust the allocation of wholesale and retail trade margins and transportation costs so that the value of these margins could be allocated to the goods that are resold by wholesalers and retailers or transported. It just rearranges the existing output, but without adding to, or subtracting from, the existing output. Therefore, each column in the margins section

[11] The use matrix could be at basic prices or the purchasers' prices. The most common case currently for available SUTs are at purchasers' prices.

sums to zero. The value of total industry output at producers' prices equals to the value of total industry output at purchasers' prices, which equals the total intermediate inputs at the purchasers' prices plus the total value added at purchasers' prices.

2. Calculate the total commodity output at producers' prices (see the equation in section 2.3)
   Total commodity output at producers' prices for each commodity is equal to total commodity output at basic prices plus the taxes on production less subsidies. The total taxes on products less subsidies column in the supply table represents the value of the taxes less subsidies that are collected on each product, however, in producers' prices, the taxes less subsidies should be considered as the collection on each industry, in the production process (Thijs, 2017). Therefore, we should use the taxes on production less subsidies row that is listed in the use (SUT) table to calculate the total commodity output at producers' prices.
3. Construct the make matrix by transposing the supply matrix in the supply table
   Since the supply table and the make table are reversed in the row and column, the make matrix could be constructed by transposing the supply matrix.
4. Use the total industry output and total commodity output at producers' prices as the row totals and column totals control and adjust the make matrix by using the Generalized RAS method (GRAS) (Junius and Oosterhaven, 2003; Lenzen et al., 2007; Temurshoev et al. 2013).
5. Check the consistency
   After the GRASing process, the column totals and the row totals of the new make matrix should be consistent with the total commodity output at producers' prices and the total industry output at producers' prices.

The conversion process for the use table (MUT) is relatively more complicated than it is for the make table:

1. Copy the total industry output and total commodity output at producers' prices from the make table converting process
2. Fill the imports goods and services column
   The imports of goods and services column is included in the use table in a MUT framework, and the supply table in the SUT framework. In the SUT framework, where the frame of reference is domestic supply, the imports column represents as part of the domestic supplies. In the MUT framework, where the frame of reference is domestic output, the imports column represents the offsetting adjustment to the value of imports

embedded in the intermediate inputs and final use sections, therefore, the imports of goods and services column in the use table on a MUT framework could be generated by reversing the sign on the imports column in the supply table on the SUT framework.[12] Furthermore, since the imports column is not included in the use (SUT) table, the row totals control of the use table in the GRASing process should be adjusted by subtracting the imports goods and services column.

3. Calculate the total value added at producers' prices (see the equation in section 2.3)
   The value added section of the use (MUT) table includes two of the same components as the value added at basic prices in the use (SUT) table: compensation of employees, and gross operating surplus. The only difference is from the taxes on production and imports less subsidies, which is equal to the sum of the other taxes on production (part of the value added at basic prices) plus taxes on production less subsidies.
   Similar to total industry output, the difference between the total value added at producers' prices and the total value added at purchasers' prices is the total margins. Since the total margins sum to zero, the total value added at producers' prices should equal to the total value added at purchasers' prices.
4. Construct the use and final demands matrix at producers' prices by subtracting the detail margins matrix from the use and final demands matrix at purchasers' prices
   The statistics in the use (SUT) table are valued at purchasers' prices, which shows inputs to industries and final uses of goods or service, including the costs of transporting the goods to the user as well as any wholesale and retail markups incurred while bringing the product to market. Therefore, before the GRASing process, the use and final demands matrix at the purchasers' prices should subtract the detail margins matrix, in order to get the corresponding matrix at producers' prices.
5. Use the total intermediate inputs and adjusted total use of commodities as the column totals and row totals control, adjust the use and final demands matrix by using the GRAS method
6. Check the consistency
   After the GRASing process, the column totals and the row totals of the new use and final demands matrix should be consistent with

[12] If the import duties column is existed in the supply table, the imports goods and services column in the use (MUT) table should be generated by reversing the sign on the sum of the imports and import duties columns.

the total intermediate inputs at producers' prices and the adjusted total use of commodities at producers' prices.

Table 7 in the Appendix shows the conversion result of the make table of Austria 2010. The total commodity output at producers' prices is equal to the total industry output at producers' prices, which is 576,295 million euros.

Table 8 in the Appendix shows the conversion result of the use table (MUT) of Austria 2010. The total intermediate use at producers' prices is 281,663 million euros. The total final uses of final consumption, gross formation, and exports at producers' prices are 223,859 million euros, 66,738 million euros, 137,932 million euros, respectively. These values are consistent with the values at purchasers' prices since the total margins are sum to zero. The total imports goods and services is -133,898 million euros, which is negative of the total imports value in the supply table. The total value added and the total industry output at producers' prices are 294,361 million euros and 576,295 million euros. These values are consistent with the values at purchasers' prices as well, due to the total margins' summing to zero.

The make-use framework shows the equivalence of make and use at producers' prices. The total balance value is 576,295 million euros. The balance is held in both the make table and use table, and between these two tables. Another noteworthy feature is that the total value added by industries is equal to total final uses, which is the value of GDP at 294,631 million euros.

4. Conclusion

In 2015, the BEA published the briefing for converting the make-use framework to supply-use framework; this paper fills in the blank of the other side, from the supply-use framework to the make-use framework. The conversion process in this paper includes all the details among the basic prices, producers' prices and the purchasers' prices systems, which provides a reference for estimating the values in different price systems. It will also provide a standard for IMPLAN to generate international data in the MUT framework from any data published in the SUT framework, thereby expanding the international data products available in IMPLAN software.

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Appendix

Figure 1. Linkage among the price systems

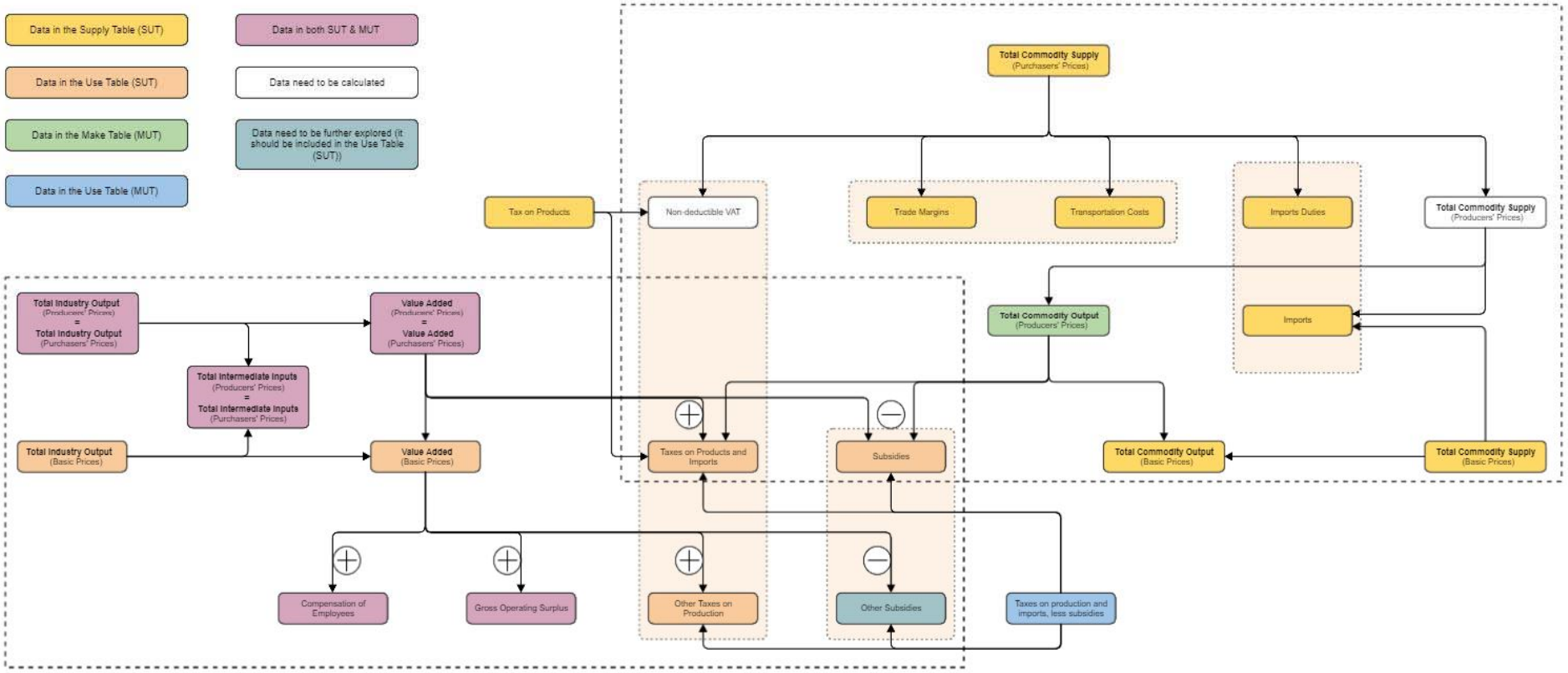

Table 5. Supply table of Austria 2010 (million euros)

Supply Table (SUT)		Industries							Total Commodity Output (basic prices)	Imports	Total Commodity Supply (basic prices)	Total Trade Margins and Transportation Costs	Total Taxes on products less Subsidies	Total Commodity Supply (purchasers' prices)
		A01	A02	A03	...	S96	T	U						
Commodities	A01	5376	0	0	...	0	0	0	5376	2325	7702	1767	209	9678
	A02	0	2180	0	...	0	0	0	2180	625	2805	488	31	3324
	A03	0	0	42	...	0	0	0	42	50	92	43	8	143
	B	4	0	0	...	0	0	0	1760	7620	9380	1023	118	10521
	C10-12	688	0	0	...	0	0	0	16437	6629	23066	7986	4154	35207
	C13-15	0	0	0	...	0	0	0	2855	6279	9134	5646	1864	16643
	C16	18	62	0	...	0	0	0	6812	1387	8199	959	151	9309
	C17	0	0	0	...	0	0	0	5695	2308	8002	1422	180	9604
	C18	1	0	0	...	0	0	0	2589	61	2650	1	46	2696
	C19	0	0	0	...	0	0	0	3885	5419	9304	2677	5280	17261
	C20	0	0	0	...	1	0	0	12058	12165	24223	3174	562	27959
	C21	0	0	0	...	0	0	0	2743	4016	6759	3361	517	10638
	C22	0	0	0	...	0	0	0	4905	4098	9002	1622	273	10897
	C23	1	0	0	...	0	0	0	5324	1773	7097	1265	167	8529
	C24	0	0	0	...	0	0	0	12656	8062	20718	1440	44	22202
	C25	1	0	0	...	0	0	0	10198	4439	14637	2025	242	16904
	C26	0	0	0	...	0	0	0	4072	8140	12213	2933	685	15830
	C27	0	0	0	...	0	0	0	7392	5624	13016	2055	415	15486
	C28	0	0	0	...	0	0	0	14598	11357	25955	3265	121	29341
	C29	0	0	0	...	0	0	0	10489	10834	21323	2496	1396	25216
	C30	0	0	0	...	0	0	0	3306	1748	5054	348	116	5518
	C31_32	1	0	0	...	1	0	0	6100	4568	10668	4338	1518	16524
	C33	3	0	0	...	2	0	0	7079	615	7694	0	74	7768
	D	1	0	0	...	0	0	0	22144	858	23002	0	1731	24732
	E36	0	0	0	...	0	0	0	721	0	721	0	56	777
	E37-39	1	0	0	...	0	0	0	6019	1581	7600	485	145	8230
	F	96	0	0	...	0	0	0	44021	491	44513	0	1602	46115
	G45	1	0	0	...	0	0	0	7070	26	7095	-2345	543	5293
	G46	0	0	0	...	5	0	0	30642	465	31107	-28013	40	3134
	G47	0	0	0	...	30	0	0	19445	0	19445	-19445	0	0
	H49	14	0	0	...	0	0	0	13952	3661	17613	-1740	-58	15815
	H50	0	0	0	...	0	0	0	91	1111	1201	-77	3	1128
	H51	0	0	0	...	0	0	0	3075	921	3996	-2	62	4056
	H52	0	0	0	...	1	0	0	8113	1622	9734	-682	133	9185
	H53	0	0	0	...	0	0	0	2363	200	2562	0	19	2582
	I	164	0	0	...	36	0	0	20695	1625	22320	0	2170	24490
	J58	0	0	0	...	0	0	0	3206	1540	4746	1286	316	6348
	J59_60	0	0	0	...	0	0	0	2096	632	2728	134	157	3019
	J61	0	0	0	...	0	0	0	6369	621	6990	0	519	7508
	J62_63	1	1	0	...	3	0	0	10422	1417	11839	0	258	12098
	K64	0	0	0	...	0	0	0	13951	1009	14961	0	25	14986
	K65	0	0	0	...	0	0	0	5644	487	6131	-20	1079	7190
	K66	0	0	0	...	0	0	0	2826	93	2919	0	1	2920
	L68A	0	0	0	...	0	0	0	17925	0	17925	0	73	17998
	L68B	6	0	0	...	8	0	0	21407	75	21482	0	1739	23221
	M69_70	0	0	0	...	6	0	0	15641	1231	16872	0	522	17394
	M71	0	0	0	...	0	0	0	7707	439	8145	0	208	8353
	M72	2	0	0	...	0	0	0	8234	602	8836	0	6	8843
	M73	0	0	0	...	0	0	0	5268	877	6145	0	192	6336
	M74_75	1	0	0	...	0	0	0	2086	52	2139	0	120	2259
	N77	5	0	0	...	8	0	0	7338	842	8180	0	367	8548
	N78	1	0	0	...	0	0	0	4194	92	4286	0	44	4330
	N79	1	0	0	...	0	0	0	2151	47	2198	0	37	2235
	N80-82	14	0	0	...	1	0	0	6390	238	6628	0	354	6981
	O	0	0	0	...	0	0	0	20731	54	20784	0	0	20784
	P	1	0	0	...	0	0	0	15719	46	15765	0	105	15870
	Q86	0	0	0	...	1	0	0	19687	89	19776	0	88	19864
	Q87_88	0	0	0	...	0	0	0	5995	382	6377	0	225	6602
	R90-92	1	0	0	...	0	0	0	3193	286	3480	86	621	4186
	R93	1	0	0	...	0	0	0	1688	9	1696	0	222	1918
	S94	0	0	0	...	0	0	0	3141	0	3141	0	0	3141
	S95	0	0	0	...	1	0	0	989	5	993	0	72	1065
	S96	1	0	0	...	2631	0	0	2905	27	2933	0	349	3281
	T	0	0	0	...	0	177	0	177	0	177	0	0	177
	U	0	0	0	...	0	0	0	0	0	0	0	0	0
Total supply (basic prices)		6401	2243	42	...	2734	177	0	543979	133898	677876	0	32317	710192

Table 6. Use Table (at purchasers' prices) of Austria 2010 (million euros)

Use Table (SUT)		Industries							Total Intermediate Use (purchasers' prices)	Final Demand (purchasers' prices)				Total Use of commodities (purchasers' prices)
		A01	A02	A03	...	S96	T	U		Final Consumption Expediture	Gross Capital formation	Exports of goods and services	Total Final Use	
Commodities	A01	1298	0	0	...	1	0	0	5454	3076	272	876	4224	9678
	A02	7	921	0	...	0	0	0	2748	394	89	94	577	3324
	A03	0	0	5	...	0	0	0	53	85	1	3	89	143
	B	15	1	0	...	3	0	0	8926	91	-38	1543	1595	10521
	C10-12	641	1	7	...	27	0	0	8222	19140	111	7734	26985	35207
	C13-15	21	1	0	...	8	0	0	1941	11034	259	3410	14702	16643
	C16	36	1	0	...	0	0	0	4362	131	1323	3493	4947	9309
	C17	11	3	0	...	23	0	0	4290	743	176	4396	5314	9604
	C18	1	0	0	...	2	0	0	1868	1	11	816	829	2696
	C19	309	51	2	...	41	0	0	7696	6824	-57	2797	9564	17261
	C20	255	7	0	...	63	0	0	13358	2999	576	11026	14601	27959
	C21	6	0	0	...	0	0	0	2172	4141	4	4322	8466	10638
	C22	47	1	0	...	23	0	0	5465	1085	496	3851	5432	10897
	C23	20	0	1	...	0	0	0	5080	472	745	2233	3450	8529
	C24	0	0	0	...	0	0	0	11226	7	727	10241	10976	22202
	C25	73	16	0	...	3	0	0	9223	766	1036	5879	7681	16904
	C26	0	0	0	...	0	0	0	3674	3156	2997	6003	12157	15830
	C27	5	0	0	...	35	0	0	4452	2193	1532	7309	11034	15486
	C28	7	0	0	...	0	0	0	8098	279	6324	14639	21242	29341
	C29	1	0	0	...	0	0	0	5001	4583	4205	11427	20215	25216
	C30	0	0	0	...	0	0	0	1299	599	906	2714	4219	5518
	C31_32	2	0	0	...	19	0	0	1675	7551	2986	4313	14850	16524
	C33	284	62	1	...	4	0	0	4747	0	2078	943	3021	7768
	D	120	7	2	...	27	0	0	18070	4889	-14	1788	6663	24733
	E36	5	0	0	...	1	0	0	775	0	0	3	3	777
	E37-39	4	1	0	...	3	0	0	7041	127	24	1037	1189	8230
	F	64	33	3	...	35	0	0	19725	1620	24141	628	26389	46115
	G45	25	1	1	...	7	0	0	1891	3235	58	108	3401	5293
	G46	6	0	0	...	0	0	0	2613	0	42	479	521	3134
	G47	0	0	0	...	0	0	0	0	0	0	0	0	0
	H49	4	0	0	...	2	0	0	5959	5293	0	4562	9856	15815
	H50	0	0	0	...	0	0	0	713	26	0	389	415	1128
	H51	1	0	0	...	4	0	0	1793	1299	0	964	2263	4056
	H52	7	2	0	...	3	0	0	5238	2254	0	1693	3947	9185
	H53	5	0	0	...	3	0	0	1930	275	0	377	651	2582
	I	8	1	0	...	7	0	0	3417	18805	0	2268	21073	24490
	J58	2	0	0	...	8	0	0	2815	2130	461	941	3533	6348
	J59_60	0	0	0	...	1	0	0	1462	1144	133	280	1557	3019
	J61	12	1	0	...	6	0	0	3978	2832	0	698	3530	7508
	J62_63	1	1	0	...	17	0	0	5784	0	4385	1928	6313	12098
	K64	124	11	0	...	50	0	0	10729	2457	0	1800	4257	14986
	K65	22	2	0	...	8	0	0	2157	4150	0	883	5033	7190
	K66	0	0	0	...	1	0	0	2537	281	0	102	383	2920
	L68A	0	0	0	...	0	0	0	0	17998	0	0	17998	17998
	L68B	36	3	1	...	186	0	0	14521	7559	1022	119	8700	23221
	M69_70	16	4	1	...	99	0	0	15359	418	75	1542	2035	17394
	M71	11	5	0	...	1	0	0	4682	115	2362	1195	3672	8353
	M72	0	0	0	...	0	0	0	308	131	6804	1600	8535	8843
	M73	5	1	0	...	14	0	0	5557	9	7	763	779	6336
	M74_75	111	2	0	...	7	0	0	1740	385	0	134	518	2259
	N77	67	17	1	...	16	0	0	6370	1385	0	793	2178	8548
	N78	4	1	0	...	15	0	0	4258	0	0	72	72	4330
	N79	1	0	0	...	0	0	0	259	1931	0	45	1976	2235
	N80-82	25	2	0	...	15	0	0	5188	1447	145	201	1793	6981
	O	1	0	0	...	1	0	0	811	19843	0	130	19973	20784
	P	2	0	0	...	0	0	0	596	15257	0	18	15274	15870
	Q86	0	0	0	...	0	0	0	536	19184	0	144	19328	19864
	Q87_88	0	0	0	...	0	0	0	0	6602	0	0	6602	6602
	R90-92	0	0	0	...	0	0	0	407	3265	334	179	3779	4186
	R93	0	0	0	...	0	0	0	38	1873	0	8	1881	1918
	S94	1	0	0	...	2	0	0	278	2863	0	0	2863	3141
	S95	2	0	0	...	1	0	0	705	358	0	2	360	1065
	S96	1	0	0	...	43	0	0	390	2890	0	1	2891	3282
	T	0	0	0	...	0	0	0	0	177	0	0	177	177
	U	0	0	0	...	0	0	0	0	0	0	0	0	0
Total Intermediate Inputs (purchasers' prices)		3732	1163	29	...	838	0	0	281663	223859	66738	137932	428529	710192
Compensation of employees		300	208	2	...	716	177	0	138905					
Other taxes on production		-1605	-87	0	...	36	0	0	3950					
Gross operating surplus		3974	958	11	...	1144	0	0	119460					
Value Added (basic prices)		2669	1080	14	...	1896	177	0	262315					
Total Industry Output (basic prices)		6401	2243	42	...	2734	177	0	543979					
Taxes on production less subsidies		515	56	9	...	329	0	0	32317					
Value Added (purchasers' prices)		3183	1136	22	...	2225	177	0	294632					

Table 7. Make Table (at producers' prices) of Austria 2010 (million euros)

Make Table (MUT)		Commodities							Total Industry Output (producers' prices)
		A01	A02	A03	...	S96	T	U	
Industries	A01	5891	0	0	...	1	0	0	6916
	A02	0	2236	0	...	0	0	0	2299
	A03	0	0	51	...	0	0	0	51
	B	0	0	0	...	0	0	0	2367
	C10-12	0	0	0	...	0	0	0	20829
	C13-15	0	0	0	...	0	0	0	4755
	C16	0	0	0	...	0	0	0	7566
	C17	0	0	0	...	0	0	0	6075
	C18	0	0	0	...	0	0	0	2973
	C19	0	0	0	...	0	0	0	8295
	C20	0	0	0	...	0	0	0	12844
	C21	0	0	0	...	0	0	0	4027
	C22	0	0	0	...	0	0	0	5538
	C23	0	0	0	...	0	0	0	6415
	C24	0	0	0	...	0	0	0	13306
	C25	0	0	0	...	0	0	0	12192
	C26	0	0	0	...	0	0	0	5439
	C27	0	0	0	...	0	0	0	10250
	C28	0	0	0	...	1	0	0	16950
	C29	0	0	0	...	0	0	0	13067
	C30	0	0	0	...	0	0	0	2414
	C31_32	0	0	0	...	3	0	0	8453
	C33	0	0	0	...	0	0	0	5193
	D	0	0	0	...	1	0	0	23932
	E36	0	0	0	...	0	0	0	747
	E37-39	0	0	0	...	3	0	0	5755
	F	0	0	0	...	0	0	0	44966
	G45	0	0	0	...	0	0	0	8185
	G46	0	0	0	...	0	0	0	30654
	G47	0	0	0	...	61	0	0	20412
	H49	0	0	0	...	2	0	0	15134
	H50	0	0	0	...	0	0	0	116
	H51	0	0	0	...	0	0	0	3256
	H52	0	0	0	...	0	0	0	9613
	H53	0	0	0	...	0	0	0	2531
	I	0	0	0	...	170	0	0	22758
	J58	0	0	0	...	0	0	0	2862
	J59_60	0	0	0	...	0	0	0	2351
	J61	0	0	0	...	0	0	0	7228
	J62_63	0	0	0	...	0	0	0	7699
	K64	0	0	0	...	0	0	0	15627
	K65	0	0	0	...	0	0	0	6995
	K66	0	0	0	...	0	0	0	2813
	L68A	0	0	0	...	0	0	0	18368
	L68B	0	0	0	...	0	0	0	19455
	M69_70	0	0	0	...	0	0	0	12745
	M71	0	0	0	...	0	0	0	7083
	M72	0	0	0	...	0	0	0	1470
	M73	0	0	0	...	0	0	0	4426
	M74_75	0	0	0	...	0	0	0	1330
	N77	0	0	0	...	0	0	0	5934
	N78	0	0	0	...	0	0	0	2867
	N79	0	0	0	...	0	0	0	2200
	N80-82	0	0	0	...	7	0	0	6466
	O	0	0	0	...	1	0	0	22834
	P	0	0	0	...	0	0	0	18363
	Q86	0	0	0	...	37	0	0	21433
	Q87_88	0	0	0	...	0	0	0	6269
	R90-92	0	0	0	...	0	0	0	3974
	R93	0	0	0	...	1	0	0	1960
	S94	0	0	0	...	0	0	0	3666
	S95	0	0	0	...	0	0	0	367
	S96	0	0	0	...	2946	0	0	3063
	T	0	0	0	...	0	177	0	177
	U	0	0	0	...	0	0	0	0
Total Commodity Output (producer prices)		5891	2236	51	...	3234	177	0	576295

Table 8. Use Table (at producers' prices) of Austria 2010 (million euros)

	Use (MUT)	Industries							Total Intermediate Use (producers' prices)	Final Demand (producers' prices)					Total Use of commodities (producers' prices)
		A01	A02	A03	...	S96	T	U		Final Consumption Expediture	Gross Capital formation	Exports of goods and services	Imports goods and services	Total Final Use	
Commodities	A01	1316	0	0	...	1	0	0	5294	1928	267	727	-2325	597	5891
	A02	6	928	0	...	0	0	0	2382	316	80	83	-625	-146	2236
	A03	0	0	4	...	0	0	0	43	55	1	3	-50	8	51
	B	12	1	0	...	2	0	0	8467	61	-56	986	-7620	-6629	1838
	C10-12	576	1	6	...	21	0	0	6779	12488	87	7453	-6629	13399	20178
	C13-15	16	1	0	...	6	0	0	1695	6058	188	2965	-6279	2932	4627
	C16	30	1	0	...	0	0	0	3909	70	1112	3304	-1387	3099	7008
	C17	9	2	0	...	19	0	0	3744	400	160	3841	-2308	2093	5837
	C18	1	0	0	...	2	0	0	1862	1	11	806	-61	757	2619
	C19	242	40	1	...	33	0	0	6178	4841	-71	1744	-5419	1095	7273
	C20	218	5	0	...	38	0	0	12170	1548	528	10498	-12165	409	12578
	C21	4	0	0	...	0	0	0	1796	2485	0	2899	-4016	1368	3164
	C22	36	1	0	...	19	0	0	4562	643	354	3689	-4098	589	5151
	C23	16	0	1	...	0	0	0	4469	235	537	2078	-1773	1078	5547
	C24	0	0	0	...	0	0	0	10692	5	705	9461	-8062	2109	12802
	C25	53	11	0	...	2	0	0	8357	410	946	5281	-4439	2198	10555
	C26	0	0	0	...	0	0	0	3079	2004	2465	5269	-8140	1597	4676
	C27	4	0	0	...	29	0	0	3774	1309	1389	7003	-5624	4077	7851
	C28	5	0	0	...	0	0	0	6880	164	5387	13720	-11357	7914	14794
	C29	1	0	0	...	0	0	0	4553	3663	3612	10921	-10834	7361	11914
	C30	0	0	0	...	0	0	0	1228	351	865	2690	-1748	2157	3386
	C31_32	2	0	0	...	15	0	0	1339	4218	2429	4023	-4568	6103	7443
	C33	281	62	1	...	4	0	0	4754	0	2077	938	-615	2400	7154
	D	116	6	2	...	27	0	0	17865	4629	-14	1737	-858	5493	23358
	E36	5	0	0	...	1	0	0	725	0	0	2	0	2	727
	E37-39	4	1	0	...	3	0	0	6716	79	21	879	-1581	-602	6114
	F	62	32	3	...	35	0	0	19655	1561	23987	621	-491	25678	45333
	G45	25	1	1	...	7	0	0	2350	4010	675	538	-26	5198	7548
	G46	190	11	2	...	56	0	0	13450	6186	2350	9398	-465	17469	30919
	G47	15	2	0	...	4	0	0	749	17981	975	0	0	18956	19705
	H49	20	1	0	...	4	0	0	7332	5556	114	5003	-3661	7013	14345
	H50	1	0	0	...	0	0	0	766	36	1	402	-1111	-671	94
	H51	1	0	0	...	4	0	0	1813	1273	0	969	-921	1321	3134
	H52	13	2	0	...	4	0	0	5757	2313	52	1843	-1622	2586	8343
	H53	5	0	0	...	4	0	0	1956	270	0	380	-200	450	2406
	I	8	1	0	...	7	0	0	3521	18826	0	2329	-1625	19530	23050
	J58	2	0	0	...	6	0	0	2420	1272	372	864	-1540	967	3387
	J59_60	0	0	0	...	1	0	0	1478	1007	135	264	-632	773	2252
	J61	12	1	0	...	6	0	0	3987	2749	0	695	-621	2823	6810
	J62_63	1	1	0	...	17	0	0	5731	0	4325	1891	-1417	4799	10529
	K64	128	11	1	...	53	0	0	11194	2486	0	1868	-1009	3344	14539
	K65	22	2	0	...	8	0	0	2189	4069	2	896	-487	4481	6670
	K66	0	0	0	...	1	0	0	2599	283	0	106	-93	296	2895
	L68A	0	0	0	...	0	0	0	0	18368	0	0	0	18368	18368
	L68B	35	3	1	...	185	0	0	14429	7253	1011	117	-75	8306	22735
	M69_70	15	3	1	...	98	0	0	15067	397	73	1501	-1231	741	15808
	M71	11	5	0	...	1	0	0	4659	110	2342	1179	-439	3193	7852
	M72	0	0	0	...	0	0	0	310	127	6838	1599	-602	7963	8272
	M73	5	1	0	...	14	0	0	5437	9	6	742	-877	-120	5317
	M74_75	107	2	0	...	7	0	0	1693	363	0	129	-52	439	2133
	N77	65	17	1	...	16	0	0	6284	1319	0	775	-842	1252	7536
	N78	4	1	0	...	15	0	0	4220	0	0	70	-92	-21	4198
	N79	1	0	0	...	0	0	0	269	1935	0	46	-47	1935	2203
	N80-82	24	2	0	...	15	0	0	5104	1375	142	196	-238	1475	6579
	O	1	0	0	...	1	0	0	873	20699	0	139	-54	20784	21657
	P	2	0	0	...	0	0	0	632	15637	0	19	-46	15609	16241
	Q86	0	0	0	...	0	0	0	579	20050	0	155	-89	20115	20695
	Q87_88	0	0	0	...	0	0	0	0	6779	0	0	-382	6397	6397
	R90-92	0	0	0	...	0	0	0	423	3287	258	185	-286	3444	3867
	R93	0	0	0	...	0	0	0	39	1885	0	8	-9	1885	1924
	S94	1	0	0	...	2	0	0	306	3054	0	0	0	3054	3360
	S95	1	0	0	...	1	0	0	680	333	0	2	-5	330	1010
	S96	1	0	0	...	44	0	0	400	2861	0	1	-27	2835	3234
	T	0	0	0	...	0	0	0	0	177	0	0	0	177	177
	U	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Total Intermediate Inputs (producers' prices)		3732	1163	29	...	838	0	0							
Compensation of employees		300	208	2	...	716	177	0							
Taxes on production and imports, less subsidies		-1091	-30	9	...	365	0	0							
Gross operating surplus		3974	958	11	...	1144	0	0							
Value Added (producers' prices)		3183	1136	22	...	2225	177	0						294631	
Total Industry Output (producers' prices)		6916	2299	51	...	3063	177	0		223859	66738	137932	-133898		576295

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US Rural and Urban Poverty Rates and Commuting Costs

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Abstract: Historically poverty rates in US nonmetropolitan ("rural") counties have on average exceeded those in metropolitan ("urban") counties. One set of investigated reasons revolves around transportation, with rural workers mostly captive to private vehicles in their journeys to work. This brief work hypothesizes that the annual national rural poverty rate (RPR) and metropolitan poverty rate (MPR) can each be specified as a function of the national unemployment rate (UR, to control for macroeconomic conditions) and a variable to measure commuting costs (CCOST). In the case of CCOST, two different measures are used: the nominal price of gasoline, and the BLS CPI index of transportation costs. Regressions using 1985-2015 data show that for the MPR (urban) equations, both the UR coefficients and the CCOST coefficients are significant and of the correct signs; however, for the RPR (rural) regressions, while the UR coefficients are significant, neither of the CCOST measures are. It is surmised that the lack of transport substitutes (public transit) might explain this rural result, and that other policies rather than accessibility should be explored in looking at rural labor market outcomes.

1. Introduction

In recent decades the poverty rate in US urban areas has been substantially less than the rural rate. Over the 1985-2015 period, the urban poverty rate averaged less than twelve percent, while the rural rate was almost sixteen percent (see Table 1). One possible reason for rural communities being at a disadvantage compared to urban areas involves transportation, especially in terms of journey to work. Based on data from 2000, Partridge and Rickman (2006) report that nearly fourteen percent of rural commuters had journey to work commute times of 45 to 90 minutes. They also find that a lack of public transportation (e.g. buses, light rail) increases reliance on the automobile. In a study of employment of single mothers, Baum (2009) concludes that car ownership increases the likelihood of employment in both urban and rural areas. Shelton et al (2002), in a survey of rural employers, determine that

transportation issues ranked second on a list of problems in hiring "welfare-to-work" employees, behind lack of "soft skills".

The terms "rural" and "urban" can vary in their applications depending on the data and methodology used. In this paper, "urban" refers to data about metropolitan statistical areas (MSAs), while "rural" refers to non-MSA regions. About 21 percent of the US population identifies itself as "rural residents" (Florida, 2017, 153). This came to about sixty million persons in 2015 (US Bureau of the Census 2016).

Rural workers reportedly travel on average 38 percent longer distances than do urban employees (Brown and Schafft, 2011, 199); however, commuting time seems to be the same for both groups of workers (152). Over half of the US rural population lives in locations adjacent to metropolitan areas (Leigh and Blakely, 2013, 25), and many rural settings have become "bedroom communities" to nearby urban centers (Pender and Dinterman, 2014, 271). The latter point might point to so-called "spread effects" that urban economic growth might have on neighboring rural ("exurban") areas, compared to "backwash" effects impacting more distant rural communities (Partridge, Bollman et al., 2006).

Some (relatively isolated) rural areas have been described as "transit deserts," with no public transit available (Jiao and Dillivan, 2013). Seekins et al. (2007) report that around forty percent of the US rural population lives in counties with no public transportation, and that only five percent of Federal transit subsidies go to rural areas (110). This lack of public transit, and increased reliance on the auto, may make it more difficult for some rural residents to access employment, compared to urban labor markets; this in turn would raise the rural over the urban poverty rate.

An indirect piece of evidence is found in a study of rural transit bus ridership in the Upper Great Plains, which found that the cross price elasticity between bus ridership and gasoline price to be quite inelastic (in the 0.08 to 0.22 range), implying that rural transit service and auto usage are not close substitutes (Mattson, 2008). This would reflect the difficulty for rural workers without access to reliable private car transportation to commute to work, raising the rural over the urban poverty rate. This might contribute to the adverse "backwash" effects impacting rural areas that are far from urban centers.

2. Model

In this paper two equations are specified and estimated, using annual data from 1985 to 2015:

$$RPR = f(UR, CCOST) \quad (1)$$

$$MPR = g(UR, CCOST) \quad (2)$$

where MPR= US poverty rate in metropolitan statistical areas (MSAs), as a measure of the urban poverty rate; RPR = US poverty rate outside of MSAs, as a measure of the rural poverty rate; UR = national (July) unemployment rate, as a control for macroeconomic conditions; and CCOST = a measure of commuting costs.

It is hypothesized that as UR increases, both MPR and RPR should increase, reflecting worsening macroeconomic and labor market conditions. As CCOST increases, this should also increase both poverty rates, as some commuters may find it too costly to access their jobs. Data sources are discussed below. Summary data measures are presented in Table 1.

Table 1. Summary statistics (1985-2015)

Variable	Mean	Std. deviation	Minimum	Maximum
MPR	12.90	1.163	10.80	14.90
RPR	15.89	1.273	13.40	18.30
UR	6.135	1.475	4.00	9.500
COMCOST	156.0	35.88	102.3	217.4
GASPRICE	1.920	1.013	0.8900	3.654

CCOST is measured in two ways. COMCOST is the Consumer Price Index's (CPI) transportation cost index estimated by the Bureau of Labor Statistics (BLS), and would include public transit as well as private automobile expenses. GASPRICE is the average annual national nominal price per gallon for gasoline, also reported by the BLS. The former measure might be a better explanatory of urban travel cost, while the latter of rural (given the paucity of rural public transit). However, both equations were estimated using the two CCOST measures.

Equations 1 and 2 were estimated by least squares, using the Cochrane-Orcutt method to control for serial correlation, using the GRETL regression package. The results are given in Table 2. Equations 1a and 1b use COMCOST, while equations 2a and 2b use GASPRICE.

Table 2. Regression estimates of equations 1 and 2 (t-ratios in parentheses).

Dependent variable	RPR (Eq. 1a)	RPR (Eq. 1b)	MPR (Eq. 2a)	MPR (Eq. 2b)
Constant	11.9614 (5.951)**	13.5502 (13.10)**	4.61326 (1.718)*	9.50545 (10.92)**
UR	0.359569 (3.199)**	0.3537082 (3.024)**	0.451662 (5.188)**	0.463638 (4.974)**
COMCOST	0.0091887 (0.8649)		0.0305527 (2.688)**	
GASPRICE		0.000857 (0.0038)		*0.351235 (1.912)***
R^2	0.812782	0.806426	0.878113	0.877847
F	5.321136**	4.839003**	14.52064**	12.54248**
DW	2.079511	1.915164	1.86278	1.865068

**-significant at 5 percent

In all four estimations the unemployment variable (UR) is significantly positive, as expected. In Equations 2a and 2b, the urban equations, both measures of commuting cost are significantly positive, as expected; in terms of the t-ratios, the COMCOST variable is somewhat better. However, in Equations 1a and 1b, the rural equations, while the measures of commuting cost are both positive, they are also both insignificant. In addition, the coefficients of determination and F-statistics are noticeably higher in the urban rather than the rural poverty rate equations.

3. Implications and Conclusions

Recent policy proposals include shifting some transportation funding from urban to rural regions (Webb, 2018). However, while the regression results suggest that lowering transportation costs would be one way to reduce urban poverty rates (presumably by making jobs more accessible than before), lowering such costs in rural areas may not have the same effect on rural poverty rates. This may reflect that urban labor markets tend to be "thick," whereas rural labor markets less so, reflecting fewer employment opportunities in the latter. A set of exceptions could be in exurban locations where improving access to metropolitan jobs through extending (say) public transit might not be difficult; this might reflect "spread" effects impacting such locations, compared to "backwash" effects occurring in more remote rural regions. Otherwise, looking for strategies to reduce rural poverty might involve tactics other than lower transportation costs. An improved macroeconomic climate, reflected in

lower unemployment rates, should also lower both rural and urban poverty rates.

Notes

Data Sources

The unemployment rate (UR) comes for the Bureau of Labor Statistics (BLS), and are July values for each year (Series LNS 1400000 ("Unemployment rate"). MPR is measured as the percent of people "inside metropolitan statistical areas," and RPR is measured as percent of people "outside metropolitan statistical areas." MPR and RPR data are from the U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplements, Table 8. Note that data for 2004 are not available, and instead were estimated as averages of the 2003 and 2005 reported values. COMCOST is proxied by the BLS' US Transportation index, series CUUR0000SAT (1982-84=100). GASPRICE is from BLS' average gasoline price series, APU00007471A.

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Externalities, Zoning, and Public Policy

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Abstract: Externalities are frequently the economic justification given for zoning and other land use controls. Not all externalities are created equal, however, and the type of externality is important for economic efficiency. This paper argues that many of the externalities used to justify zoning are pecuniary externalities. Pecuniary externalities do not allocate resources externally to the market and thus do not represent inefficiency in need of corrective action. Public policy toward pecuniary externalities matters because corrective action in response to pecuniary externalities can generate inefficiency.

1. Introduction

Externalities, or third party effects, are at the core of the normative economic reasoning for land use controls such as zoning (Fischel 1980; Wolfram 1981; Chung 1994). The presence of consumption or production externalities is the primary economic justification for zoning (Pogodinzinski and Sass 1990). The incompatible use of nearby land is a common example of a negative externality in the zoning literature, such as the presence of a high-rise apartment next door to a single-family home (Ihlanfeldt 2004). The argument states that in the absence of assurance that a neighborhood will conform to a certain standard, either through land use controls or private contracts, it will result in individuals consuming less housing at any given price (Pogodinzinski and Sass 1990).

The construction of a high-rise among single family homes clearly generates third-party effects as the actions of the developer affect the welfare of other nonconsenting parties. What is not clear, however, is whether the presence of externalities necessitates corrective action to improve economic welfare. Not all externalities misallocate resources (Holcombe and Sobel 2000) and welfare losses are *prima facie* evidence of externalities requiring corrective action. In order to know whether resources are being allocated inefficiently, it must be determined whether the externalities are technological or pecuniary (Holcombe and Sobel 2001).

In this paper, I argue that some externalities presented as justification for land use controls are pecuniary in that no resources are allocated external to the

market process. Since all costs are felt through market prices for assets, corrective action is not needed to ensure market efficiency. More importantly, while the presence of pecuniary externalities does not require corrective action on the part of government it is the primary motivation for government imposition of land use controls. Thus instead of moving land use markets towards efficiency, government action toward pecuniary externalities in the market for land misallocates resources and moves markets away from efficiency. By short-circuiting the market process, zoning for pecuniary externalities inhibits entrepreneurship in urban form and design that is necessary for cities to evolve to satisfy current and future consumer demands.

2. Pecuniary vs. technological externalities

Assume that absent zoning, a developer would build a high-rise next to a single-family home. Further assume that the homeowner suffers a welfare loss as a result of the developer's actions. From the standpoint of economic efficiency, does this welfare loss require corrective action? The answer is unclear without knowing exactly what characteristic related to the building of a high-rise next door caused the welfare loss.

It could be that the homeowner is a gardener and uses a portion of her backyard to grow vegetables for her dinner. The construction of a high-rise next door blocks the sun from her yard for several hours a day, greatly reducing the yield she can get from her garden and reducing her economic welfare. In this case the presence of a building would represent a *technological externality* as the construction of the high-rise directly affected household production in the single-family home, causing a welfare loss.

Now assume that the high-rise is constructed but the single-family homeowner is not a gardener. While she does not mind the presence of a high-rise next door, she knows that most potential buyers of her home or others in the neighborhood will not like having a high-rise next door blocking their sun for most of the day. As a result of other people's dislike of incompatible land usage, the future income stream she can obtain from her home is diminished by an amount equivalent to the welfare loss from the first example. In this case the presence of the nearby building would represent a *pecuniary externality* as the third-party effects are transmitted through the price system.

A more formal treatment of the distinction between pecuniary and technological externalities in the context of production externalities can be found in Scitovsky (1954). Holcombe and Sobel (2000) extended the analysis from the production side to the consumption side.

3. Why pecuniary externalities do not represent inefficiency

The welfare losses from pecuniary externalities are real. Why then are they not inefficient? The reason is because

they do not lead to an inefficient allocation of resources since no resources are allocated external to the market (Holcombe 2006). From an efficiency standpoint, individuals have a right to the ownership of resources but not to the value of those resources. A homeowner has a right to her house and the land below it but not to a future income stream from the house. From the standpoint of economic efficiency there is no difference between the following two situations: 1) attractive new brownstones are built in a renovated downtown, lowering demand to live elsewhere in the city and causing each homeowner a $5000 capital loss; and 2) a homeowner incurring a $5000 capital loss because her next door neighbors fail to maintain their property according to conventional norms.

An individual who is made worse off by a pecuniary externality is made so by the changing supply and demand conditions for their home. The failure to maintain a home affects nearby housing values because it lowers demand for housing in the neighborhood. Because there are no resources being allocated outside the market system and all the costs are reflected in market prices (for both houses) the failure to maintain a home does not represent a misallocation of resources. Although the value of housing in a neighborhood may decline because of one homeowner's subjective valuation of aesthetic beauty, that does not represent a misallocation any more than an exogenous change in the demand to live in a neighborhood. Thus resources are allocated optimally when pecuniary externalities are not handled through public policy.

One might note that it is possible for an individual to be affected by both technological and pecuniary externalities. Using the same example above, the gardener may be upset that the value of their home will be lowered, *and* that they do not get to grow their vegetables for their dinner. Does inefficiency exist in this case? Yes, but not to the extent that is typically thought. As stated above, the homeowner's ability to produce, use, and enjoy their property is damaged, thus inefficiency is present. The change in the value of the home is a fall in demand, but not efficient. Given the incentives of the homeowner, however, they will likely not make this distinction public. There will likely be an exaggeration, whether in the media or in court, as to the damage caused to them and their ability to use their home to produce home goods. Thus, it would be best to look at these particular cases one at a time through the courts. Zoning laws, however, create too broad of a rule to follow, especially given the incentives of homeowners to overstate their actual productive losses.

4. Positive vs. normative arguments for zoning

Fischel (1992) argues that zoning is necessary for the Tiebout process to work. Without zoning to restrict the price of entry into a municipal government, the Tiebout model breaks down as individuals seek to free-ride on others'

investments in quality government services. For example, a developer could build several small houses on a lot and sell them to families with children. Each house would consume more in education services than they would remit in property taxes. Fischel (2001) also argues that zoning helps to protect the value of most individual's greatest asset – their house. He provides a compelling explanation of how most land uses controls arose just to protect the property values of homeowners.

Fischel's explanation of *why* zoning exists in the form that it does is an excellent example of positive economic analysis. His "homevoter hypothesis" has tremendous explanatory power to explain many features of local governance and land use. For example, his argument regarding why we have individuals who say Not In My Back Yard, otherwise known as NIMBYs. In Fischel (2001), he gives a positive explanation for their behavior, namely that people are concerned about losing housing value. NIMBYs, for example, are likely to want to block a halfway house from their neighborhood because they are concerned about the halfway house lowering home values. From the perspective presented here, the loss in housing value arising from a halfway house locating in a neighborhood is merely a pecuniary externality and actually moves us away from economic efficiency. From the perspective of public policy, there is no difference between a homeowner not wanting a halfway house in their neighborhood because of fear of declining home values and McDonalds not wanting Five Guys to move next door because of declining profits. They both occur through the price system and thus are essential for the market process to work (Holcombe and Sobel 2001).

5. A plea for symmetry

Ultimately, my argument is a plea for symmetry in analysis by those using externality language. If McDonalds tries to stop Five Guys from moving next door by lobbying the local planning commission, I submit that most economists would view this as wasteful rent-seeking that moves the market *away* from efficiency. If a homeowner stops a duplex or mother-in-law suite from being built down the block from their home, I believe most economists would generally not view them as rent-seekers moving the market away from efficiency. Instead, they are seen as "protecting neighborhood integrity" or "protecting the value of their largest asset." While these are perfectly fine reasons to engage in their actions, they are no different than the actions of McDonalds and the mechanism (the price system) through which the potential damage will be inflicted. From the standpoint of economic efficiency, they are no different than the residents of Monessen PA wanting to protect steel jobs through tariffs on imported steel. Again, economists would largely argue against tariffs on efficiency grounds, but not NIMBYISM. Why this is the case is unclear, however to the extent that

economists views on efficiency influences public policy, this lack of symmetry in analysis contributes something to our current shortage of affordable housing in many U.S. cities (Scally and Tighe 2015).

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The Impact of Family on Female Entrepreneurs in Vietnam

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Abstract: The focus of this research is on the economic success of female owned businesses in developing countries, specifically Vietnam, and the impacts of the family on this economic success. According to the literature, it has been found that the influence of the family can have both a positive and negative effect on the success and growth of a business. Using data collected from a July 2015 survey of female entrepreneurs in Hanoi, Vietnam, the empirical results suggest that it is possible that, despite many of the survey respondents stating that their families contributed significantly to their success, the entrepreneur's skills (gained through education) and the business environment (operating a registered business in the formal sector) are more important determinants of success.

1. Female Entrepreneurship and Economic Growth

1.1 Entrepreneurship and Economic Growth

Basic macroeconomic theory states that economic growth results partly from changes in the availability of productive resources, including land, labor, capital, and entrepreneurship. Because entrepreneurship is not as clearly defined as the other three, it is not as easy to draw general conclusions about its impact on and role in the processes of growth and development.

Van Stel et al. in *The Effect of Entrepreneurial Activity on National Growth* list several notions of the importance of entrepreneurship and its positive impact on growth and development. Entrepreneurs often inject new and innovative ideas into markets and, because of this, often heavily contribute to the expansion and evolution of these industries (2005, p. 311). Audretsch and Keilbach note that the existence of entrepreneurship in this sense may be a result of the "knowledge spillover" theory. Individuals, according to this claim, start their own businesses or firms because they find that currently-available knowledge has not been fully exploited or can be employed in a

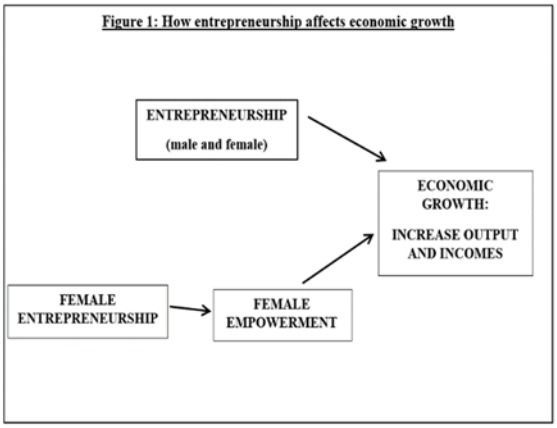
different context. Entrepreneurship in this sense could be viewed as an "endogenous response to investments made in knowledge" and this response may arguably enhance the discovery of profitable market products and designs, aiding in economic growth (Audretsch & Keilbach, 2008).

While theory often implies that entrepreneurship can lead to higher growth, the evidence is more nuanced. For example, a regression analysis by Van Stel et al. found that entrepreneurship and growth in countries with relatively high income were positively related. However, they also found that, in relatively poor countries, entrepreneurship and growth were negatively related (Van Stel et al., 2005). They attributed this to the possibility that in relatively poor countries, people become entrepreneurs because they have few alternatives. In addition, Carree and Thurik point out in *The Impact of Entrepreneurship on Economic Growth* that increased entrepreneurial activity is especially beneficial to more developed economies when compared to less developed countries due to the abundance of necessity in these countries (Corree & Thurik, 2010, 583). Thus, for people in relatively less developed countries, owning a business is a way to survive rather than to thrive and grow. According to Carree and Thurik, it is likely that entrepreneurial activity that grows out of opportunity will, on average, lead to more subsequent economic growth than necessity entrepreneurship (Corree & Thurik, 2010, 583). Results from empirical analyses show that entrepreneurship is significant; however, its exact impact on economic growth is a little less straightforward.

1.2. Female Entrepreneurship and Economic Growth

Specifically focusing on female entrepreneurship, theoretically, female entrepreneurship may affect economic growth and development through two different channels as summarized in Figure 1.

Figure 1: How entrepreneurship affects economic growth



First, entrepreneurship (whether male or female) may affect growth directly because entrepreneurs, as discussed above, are considered to be resources. In addition, entrepreneurial activity may increase the productivity of other resources. Second, female entrepreneurship may empower women. Once women can participate in the economy on an equal footing with men, they will fully realize their productive potential. The precise mechanisms through which these channels work to

enhance growth are discussed below, along with the results of empirical studies on the issues.

As women of a particular country become empowered and are able to secure better jobs for themselves, the whole economy of that country will benefit. The World Bank states that in its 2012 World Development Report on Gender Equality and Development that "for an economy to be functioning at its potential, women's skills and talents should be engaged in activities that make the best use of those abilities" (World Bank, 2012, 3). However, this statement is not always the case throughout the world. According to "Women's Empowerment and Micro-Entrepreneurship in India: Constraints and a New Development Paradigm?", women are more likely to be situated in the "unorganized, unprotected, and informal" sectors of the economy which tend not to grow and are generally a symptom of stagnation and lack of opportunity (Torri and Martinez, 2014, 31). Because women face discrimination in both economic markets and societal institutions that, for example, may prevent women from finishing their education and earning the same incomes as men, women's labor is often "underused and misallocated" (World Bank, 2012, 5); the World Bank points out that economic losses usually occur when this is the case. If gender inequality is prevalent, it is argued that the country's ability to compete internationally in diminished; this has been found to be especially true in countries that specialize in exporting goods and services that both men and women could equally produce efficiently (World Bank, 2012, 5). Additionally, in countries with aging populations, encouraging women to enter and remain in the labor force can help dampen the adverse impact of shrinking working-age populations (World Bank, 2012, 5).

Female empowerment and an increase in a country's economic growth can be arguably be achieved through a promotion of female entrepreneurship. Through the advancement of female entrepreneurship, women will become more empowered; the women that start and maintain their own businesses will not only feel a sense of independence, they may also begin to grow more confident in their abilities to succeed. As a business owner, a woman will be able to garner more respect from other people in her community and her country, especially if said sphere of existence still views women in a more traditional sense. By owning a business, the government of these women's country will potentially begin to recognize more of these women's economic significance. Through this observation, the government will begin to make more of a conscious effort to protect these women's rights and interests. Through this chain of events, women, therefore, become more willing and able to actively participate in the economic market of the country where they live, boosting economic activity and growth for the entire country beyond what was possible beforehand.

Recent studies have been conducted to determine the validity of the above claim. As noted by Ester Duflo, a "bidirectional relationship between economic development and women's empowerment" is thought to exist. Duflo's writing provides evidence that female empowerment can lead to increased economic growth. Noting evidence of this relationship, Torri and Martinez (2014) discusses the importance of the Gram Mooligai Company Limited (GMCL) in India. GMCL is the one of the first female community enterprises in India entirely created and managed by untouchables. Through their research, it was found that the GMCL enhances women's productive capabilities and leadership skills (Torri and Martinez, 2014, 31). Additionally, in its 2012 World Development Report, the World Bank found that countries with an advantage in making products that rely more on women's labor have become more gender equal because of the inclusion of women in the labor market (World Bank, 2012, 5).

2. Literature Review: Family and Entrepreneurship

The focus of this research is on the economic success of women owned businesses in developing countries, specifically Vietnam, and the impacts of the family on this economic success. According to the literature, it has been found that the influence of the family can have both a positive and negative effect on the success and growth of a business. There are several hypotheses, therefore, that can be derived from the impact of family on the success of female-owned businesses in Vietnam. Because the family can be seen as a source of capital, business success would potentially increase. Additionally, because the family can be seen as a source of labor, an increase in family involvement could increase business success. With respect to women entrepreneurs, family may be more likely to present obstacles to success than contribute positively to success because of the expectation that women should take primary responsibility for taking care of children and maintaining the household, especially in more traditional societies like that in Vietnam, thereby decreasing success. On the other hand, family involvement in a female-owned business could increase the success of that business the family could be seen as a source of emotional and moral support.

Research has identified constraints and hurdles that women entrepreneurs must overcome in order to run businesses. From lack of capital to government constraints, the types of problems that can arise are numerous. The family of a woman entrepreneur is an interesting phenomenon because the literature identifies it as both a potential constraint on success as well as a force that can increase the odds of success. The following is a review of the literature that focuses on the impact of family on entrepreneurs, both male and female. It also includes surveys conducted in Vietnam to discover the major

constraints that women entrepreneurs face when starting and maintaining a business.

2.1. Theoretical Links

Many sources in the literature explore the complex and multi-faceted nature of the relationship between entrepreneurs and their families. Aldrich and Cliff (2003) stress the importance of the "family embeddedness perspective" to the study of entrepreneurship. The authors note that entrepreneurs are not isolated when important business decisions are made; the entrepreneur is always subtly influenced by his or her social relationship and the surrounding environment. According to Aldrich and Cliff, the family and running a business are inseparably intertwined. This means, on the one hand, that the characteristics of families influence the decision to start a new venture and can affect the outcome of the venture. For example, families play a role in mobilizing resources for start-up firms. The authors go one step further and assert that the creation and outcomes of new ventures may have a feedback effect on the characteristics of the family. One possibility is that the failure of a venture may transform the family through, say, divorce. Aldrich and Cliff do not answer the many questions that follow from the "family embeddedness" perspective, but they assert that the importance of the family should not be dismissed in formal research conducted about entrepreneurship.

Dyer and Handler (1994) discuss strands of research that explore how an entrepreneur's childhood and upbringing, obviously influenced by parental circumstances and attitudes, can influence subsequent entrepreneurial behavior. A psychological view asserts that a chaotic and stressful childhood can result in an adult who starts his or her own business as a way to gain control of his or her life circumstances. Another view is that people who turn out to be entrepreneurs as adults were given opportunities by their parents to engage in entrepreneurial activities. The authors also discuss the positive and negative effects of family on the success and failure of start-up firms. Families may increase the odds of survival and even success by providing initial capital and sharing early losses. On the other hand, if operating the new company results in marital stress, the diversion of the entrepreneur's energies to family matters may doom the business. Finally, they discuss the multiple ways that employing family members, rather than outsiders, can result in the success or failure of the business venture. There is a possibility that employing family members can lead to corruption which diverts the firm's resources from productive use. Alternatively, employing family members may increase the odds of success since family members may be more committed to the success of the business than outsiders. Like the Aldrich and Cliff article above, Dyer and Handler do not provide a

definitive answer to the question of whether family exerts a positive or negative influence on entrepreneurial success, but argue that research in entrepreneurship should not ignore the links to family.

2.2. Empirical Links

Nafziger (1969) discusses the effects of the extended family on capital formation and entrepreneurial activities in Nigerian manufacturing firms. Using descriptive statistics based on a sample of twenty-eight small manufacturing firms, Nafziger concludes that the family can have both positive and negative effects on firm performance and success. He finds that family can be helpful to business owners at the start-up stage in terms of funding apprenticeships for prospective entrepreneurs and raising initial capital funds. However, he also finds that the family can be a major barrier because the presence of the family in business decision-making may deter risk taking and may even inhibit the growth and expansion of more mature firms as profits are increasingly diverted to fulfill family obligations.

Chang et al. (2013), in their study, worked to determine the relationship between the extent of entrepreneurial innovation, family involvement, and prior business experience. They tested three hypotheses on the role of family.

1. Family involvement is positively related to entrepreneurial success. The rationale for this hypothesis is that family involvement leads to more and better advice and cooperation within the firm and that the desire to pass the business on to the next generation focuses attention on long-term success.

2. Innovation increases entrepreneurial success.

3. Family involvement negatively impacts the positive relationship between the extent of innovation and entrepreneurial success. The rationale for this hypothesis is that family businesses may be slow to innovate, preferring a stable course rather than risk-taking.

Chang et al. use data on U.S. entrepreneurs from the 2003 *Inc. 500* magazine to run a series of regressions to test the hypotheses. As their dependent variable on entrepreneurial success, they use the percentage change in sales between 1998 and 2003. They use information from *Inc. 500* to construct a dummy variable on family involvement, with a value of "1" given to those firms identified as operating with the influence of the entrepreneur's family. They also construct a variable on the extent of innovation by each firm from information in *Inc. 500*. To capture the interaction of family involvement and innovation to test the third hypothesis, they create an interaction term by multiplying the variable on family involvement by the variable on innovation. They include several other controls and independent variables such as firm size, entrepreneurial experience, and the region of the U.S. in which the firm operates. They find no support in the data for the first hypothesis, family involvement increases success. According to the regression results,

family involvement is inversely related to success (sales growth), but the coefficient is not significant. After finding that innovation alone is positively and significantly correlated with success (the second hypothesis), they find that the interaction term between family involvement and innovation results in a coefficient that is negatively related to success and is statistically significant. They interpret this to imply support for the third hypothesis that family involvement moderates the effect of innovation.

In their study, Welsh et al. (2014) examined the impact of personal problems and family support and their interactive effects on the performance of female-owned firms in South Korea. They hypothesize that family moral support can moderate the negative impact of family personal problems on firm performance. The data they use come from a survey questionnaire administered to 48 South Korean women entrepreneurs. Their dependent variable on firm performance is a dummy variable based on each firm's current annual income: a value of "1" is assigned if the firm's income is higher than the national median income per person. "Personal problems" are measured by a dummy variable, with a value of "1" if the survey results revealed the "presence of any combination of emotional stress, family stress, loneliness, influence of business on family relationships, influence of business on personal relationships, poor or lack of support, time management problems…" (p. 8). "Family moral support" is also a dummy variable with a value of "1" assigned if the woman entrepreneur acknowledged support from a family member. An interaction term between the measures of "personal problems" and "family moral support" is created to test whether family involvement offsets the effect of personal problems on firm performance. In their study, Welsh et al. also included level of education, business experience, and family business ownership as three control variables. The binary logistic regression reveals that, although positive family support by itself did not significantly increase firm performance, the coefficient on the interaction term between family moral support and family personal problems was positive and statistically significant. They conclude that this provides support for the hypothesis that family support can moderate the negative impact of personal problems on the performance of female-owned businesses.

2.3. Surveys of Female Entrepreneurs in Vietnam

Regarding female entrepreneurs in Vietnam specifically, several surveys and studies have been conducted that shed light on many of the underlying constraints women business owners face. Although these surveys reveal that capital constraints seem to be the most prevalent and obvious obstacles women face when starting and running a business, family and gender-role obligations also appear to be notable constraints.

UNIDO, the United Nations Industrial Development Organization, (2010) conducted a survey that analyzed both the traditional regulatory and internal gender-based obstacles women entrepreneurs face in Vietnam when compared to male entrepreneurs. UNIDO found that both men and women are significantly more likely to consult family members on business decisions rather than make the decisions on their own. In addition, the survey found that compared to men, significantly more women believe that family responsibilities are a hindrance to the success of their businesses. In summary, the UNIDO survey concluded that women entrepreneurs in Vietnam tend to be bound to traditional gender roles and family obligations, hindering the growth and success of their businesses.

The International Finance Cooperation (IFC) conducted a survey/interview campaign of women entrepreneurs in Vietnam to try to define major constraints that women face running their businesses. By reviewing over 450 participants, the IFC was able to narrow down some of the major limitations women entrepreneurs feel they face including a lack of access to finance and finding the appropriate work-life balance when having to take care of relatives and children. One of the survey responders noted that women often feel "pressure" to stay home with the family and abandon business ideas for the sake of the family.

In a survey conducted by the Vietnam Women Entrepreneurs Council in conjunction with the International Labor Organization in 2007, eighty percent of the women entrepreneurs interviewed stated that they experience high pressure from balancing work and family life; the women interviewed saw these family responsibilities as a constraint to running their business effectively.

From the above surveys, it is difficult for one to determine the exact impact of the family on female entrepreneurs in Vietnam. Although these women may view their family as an important contributor to their business in terms of both financial and moral support, these women also noted that the traditional responsibilities of caring for their family may get in the way of running their business effectively.

2.4. Other Factors that Affect Success

In general, according to the literature, women find it more difficult to start and run a new business than men. In addition to the role of the family, there are several other factors discussed that may affect the success of women entrepreneurs, especially in developing countries such as Vietnam. Women have more difficulty, on average, in accessing capital, have less formal education when compared with men, and are limited in their business ventures because of gender stereotypes and obligations.

As an entrepreneur's access to capital decreases, one can expect the future success of his or her business to decrease. Because women have less access to

capital in developing countries, the businesses run by women in developing countries are less likely to be successful. In both the UNIDO and IFC surveys conducted in Vietnam, women noted that obtaining access to capital was one of the largest constraints they faced when operating their business, partly because of the difficulty for women in Vietnam having the collateral to obtain a loan.

As the amount of schooling and/or business training an entrepreneur receives increases, the more successful his or her business will be. As noted in Chang et al. (2013), entrepreneurs with more experience and education have developed a "learning curve" to correct shortcomings in the past and to gain insight for future entrepreneurial endeavors. In the UNIDO survey specifically, it was found that male business owners had a significantly higher level of education when compared with female business owners. Due to the lower educational attainment among women when compared with men, one can expect that businesses owned and operated by women will be less successful than their male counterparts.

In the surveys conducted in Vietnam, it was found that women entrepreneurs perceived that because they were women, it was more difficult for them to start and continue running their own business because of the corresponding social roles and values women are expected to practice. Due to these roles and values, women are limited by the types of markets they can participate in, and by the amount of time they are able to spend at their business. Due to the stereotypes about women business owners in Vietnam, women are more likely to start businesses in the informal market, when compared to men, making their business ventures more vulnerable. If a business is started in the informal market, there are less protections from failure provided by the government. As these protections decrease, the likelihood of business success also decreases. Additionally, in societies around the world, women are more likely to be found at home taking care of their family rather than spending time running a business. As the number of children a woman has increases, the less time and energy she has to devote to her business. The likelihood of business success therefore decreases with the number of children.

2.5. Summary

At both the theoretical and empirical levels, the relationship between family and entrepreneurial success is complex, with family as a factor that can potentially increase or decrease the odds of entrepreneurial success. With respect to women entrepreneurs, particularly in traditional societies like Vietnam, family may be more likely to present obstacles to success than contribute positively to success because of the expectation that women take primary responsibility for childrearing and maintaining the household. This possibility comes out in surveys such as those on women entrepreneurs in Vietnam as discussed

above, but has not been explored more formally to any great extent. Most of the formal empirical studies have focused on the impact of family on entrepreneurs in general.

Other factors that may affect the success of female entrepreneurs include access to capital, the amount of education and/or training received, and the gender stereotypes and obligations that women face in Vietnam. The research that follows uses a production function to analyze data from a survey of *female* entrepreneurs in Hanoi, Vietnam using statistical tools to explore the role of family in the success of female-owned businesses.

3. Model

There are several ways to assess the success of a business. The most obvious way is how profitable it is; another way is based on size. Successful businesses grow and produce more output over time, thus becoming larger. Below is a production function showing the variables that determine how much output (Q) a business produces and therefore its size.

$$Q = f(k, l, e, dc, sm) \quad (1)$$

There are two types of factors that determine how much output a business produces. *Internal factors* are those that result from the firm's own decisions and over which the owners and managers have some control. These include the amounts of resources employed. *External factors* are beyond the firm's direct control. They include the degree of competition the firm faces in the market and the size of the market.

Variable *k*, or capital, describes the amount of capital a business owner has access to. According to microeconomic theory, as the amount of capital *increases*, output *increases* due to an increase in productivity and specialization, other things constant.

Labor, or variable *l* in the production function above, also has a direct impact on the size of a business. The more people a firm is able to hire, the more output the firm will be able to produce and the bigger that firm will become. All else constant, as the amount of labor *increases*, output *increases*.

Variable *e* represents entrepreneurial effort. This is an important variable to include in the production function because it takes into account the time and energy the entrepreneur puts into his or her business. If the entrepreneur devotes relatively more time to his or her business, the amount of entrepreneurial effort increases. As the amount of entrepreneurial effort *increases*, output *increases,* other things constant.

The external variable *dc*, or *degree of competition*, refers to the market structure in which the business operates, that is, how much competition the business faces from other firms. At one extreme, in a pure monopoly, there is only one firm, which is likely to be large. At the other extreme is perfect competition, with many firms competing with each other, each likely to be very small. Following this strain of analysis, as the degree of

competition *increases*, the size of the firm *decreases* all else constant.

The last variable analyzed in this production function is the *size of market*, or *sm*. This variable is included because both the number of potential buyers in the market and the incomes of those potential buyers can have a direct impact on the size of a business. The output, and therefore the size, of a firm is positively related to market size. For example, the larger the market, the more output a business can potentially sell, and therefore the larger the firm will be, other things constant.

Based on this production function, there are several paths through which the entrepreneur's family can affect the amount of output produced and therefore firm size.

First, because the family can be considered a source of capital, the family's involvement in a business would, other things constant, *increase* the amount of capital (*k*) to which the business has access to; therefore, according to the model, output and the size of the business would *increase*.

Additionally, the family can also be a source of labor when the entrepreneur hires family members to work for him or her. Due to the *increase* in the amount of labor now available to the entrepreneur, the size of the business *increases*, other things constant.

Also, when specifically looking at female entrepreneurs, the family can pose a hindrance to the amount of entrepreneurial time and energy the business owner is able to put into her business. Because family responsibilities such as child care and housework *decrease* the amount of entrepreneurial time and energy (*e*) a female business owner is able to devote to her business, the size of her business, all else the same, *decreases*.

On the other hand, the presence of the family may *increase* the amount of entrepreneurial time and energy put into the business (*e*) if the family is a source of moral support and advice for the entrepreneur. Thus, according to the model, the size of the business would *increase*, other things constant.

To summarize, the hypotheses to be tested are the following:

1. Family involvement has a direct relationship with business success because family can be seen as a source of capital.
2. Family involvement has a direct relationship with business success because family can be seen as a source of labor.
3. Family involvement has a direct relationship with business success because family can provide emotional and moral support.
4. Family involvement has an inverse relationship with business success because family can take away entrepreneurial time and energy.

IV. Empirical Strategy

For the above hypotheses, the regression equation to be estimated in this section is:

SUCCESS = A + B_1YRS + B_2ED + B_3BANK + B_4REG + [B_5(Various Indicators of Family)]

The dependent variable is a measure of the "success" of the business, which is equated with its size: larger female-owned businesses are considered to be more successful than smaller ones. In turn, the size of each business is measured by an index based on the revenues the owner stated she earned in the latest year (higher revenues imply a larger firm, ceteris paribus) and the total number of employees she has (more employees imply a larger firm, ceteris paribus). Specifically:

Success/Size = .5 x firm's revenues + .5 x firm's employees

The revenues are derived by dividing the firm's revenues by the combined revenues of 46 firms and the employees are derived by dividing the firm's employees by the combined employees of 46 firms.

To test the above hypotheses, eight regression equations will be tested using ordinary least squares. The first one (1) will include the following explanatory variables: years of business ownership (YRS), a dummy variable explaining the amount of education obtained by business owners (ED), a dummy variable describing whether or not the business receives funds from a bank (BANK), and a dummy variable explaining whether or not the business is registered with the government (REG). The additional seven regression equations will include the above four explanatory variables and seven different family indicators (Various Indicators of Family) in seven different regression equations of the same form. The seven family variable are:

1. whether or not the family contributed to the capital of the business (KFAM).
2. whether or not the business is run from the family home (KHOME).
3. the share of the total employees that are family members (FAMEMP).
4. whether or not there are any children in the household (CHOUSE).
5. whether or not there are any dependents in the household (DHOUSE).
6. whether or not the business owner indicated that family plays a significant role in the success of her business (FAMSIG).
7. whether or not the business owner indicated that family plays a significant role through emotional support (FAMEM).

All of the above variables are summarized in Table 1. The variables are measured by utilizing the results of a survey of 46 female entrepreneurs in Hanoi, Vietnam conducted in July 2015. A copy of the survey questions are attached as an appendix; the survey questions on which the variables are based appear in Table 1. Table 2 provides summary statistics for the survey data. Tables 3.1 and 3.2 display the results of the ordinary least squares estimation. Standard errors are robust to heteroskedasticity.

Table 1: Summary of variables

Variable	Acronym	Survey Question Number	Type of Variable
Degree of Success (Dependent)	SUCCESS	17 & 25	Numeric (formula)
Years entrepreneur has owned business	YRS	12	Numeric
Education	ED	7	Dummy 1=bachelor's degree (or equivalent) and higher
Access to bank credit	BANK	23	Dummy 1=Has used bank credit
Registered with government	REG	13	Dummy 1=Registered
Family as source of financial capital	KFAM	24	Dummy 1=family capital most important source
Business operated from family home	KHOME	16	Dummy 1=operated from family home
Share of family employees	FAMEMP	17 & 20	Numeric (ratio)
Children in the household	CHOUSE	33	Dummy 1=children 18 and younger in the house
Dependents in the household	DHOUSE	33	Dummy 1=children 18 and younger **and/or** adults 65 and older in the household
Opinion: family plays a significant role in the success of your business	FAMSIG	38	Dummy 1=family plays significant role
Opinion: family provides emotional support	FAMEM	38	Dummy 1=volunteered that family provides emotional support

Table 2: Summary statistics

Variable	N	Mean	S.D.	min	max
Degree of success (SUCCESS)	46	2.174	2.511	0.0103	14.12
Years of experience (YRS)	46	14.36	9.294	1	42
Education (ED)	46	0.326	0.474	0	1
Access to bank credit (BANK)	46	0.174	0.383	0	1
Registered with government (REG)	46	0.761	0.431	0	1
Source of Capital (KFAM)	46	0.130	0.341	0	1
Business operated from family home (KHOME)	46	0.413	0.498	0	1
Share of family employees (FAMEMP)	46	0.153	0.296	0	1
Children in household (CHOUSE)	46	0.761	0.431	0	1
Dependents in household (DHOUSE)	46	0.826	0.383	0	1
Family plays significant role (FAMSIG)	46	0.783	0.417	0	1
Family provides emotional support (FAMEM)	46	0.326	0.474	0	1

Table 3.1: OLS estimation results

Variable	(1) NoFam	(2) KFAM	(3) KHOME	(4) FAMEMP
Years of experience	0.00942	0.00864	0.0144	0.0147
	(0.0247)	(0.0247)	(0.0266)	(0.0425)
Education	1.658**	1.602*	1.679*	1.801*
	(0.817)	(0.848)	(0.833)	(0.917)
Access to bank credit	2.117	2.096	2.086	2.195**
	(1.369)	(1.392)	(1.368)	(0.887)
Registered with the government	1.320***	1.327***	1.280***	1.340*
	(0.371)	(0.376)	(0.414)	(0.772)
Family as a source of capital		-0.265		
		(0.486)		
Business run out of family home			-0.203	
			(0.485)	
Share of family employees				0.785
				(1.074)
Constant	0.126	0.187	0.168	-0.146
	(0.439)	(0.453)	(0.474)	(1.030)
Observations	46	46	46	46
R-squared	0.408	0.409	0.409	0.416

Table 3.2: OLS estimation results

Variable	(5) CHOUSE	(6) DHOUSE	(7) FAMSIG	(8) FAMEM
Years of experience	0.00221	0.000698	0.00805	0.0138
	(0.0228)	(0.0229)	(0.0261)	(0.0250)
Education	1.601**	1.368*	1.647*	1.577*
	(0.749)	(0.686)	(0.827)	(0.782)
Access to bank credit	2.079	2.348*	2.091	2.116
	(1.263)	(1.276)	(1.384)	(1.343)
Registered with the government	1.420***	1.336***	1.289***	1.412***
	(0.386)	(0.396)	(0.414)	(0.381)
Children in the household	1.296**			
	(0.598)			
Dependents in the household		1.677**		
		(0.640)		
Family contributes to success			0.116	
			(0.524)	
Family provides emotional support				-0.549
				(0.476)
Constant	-0.808	-1.092	0.0865	0.197
	(0.666)	(0.728)	(0.474)	(0.452)
Observations	46	46	46	46
R-squared	0.457	0.471	0.408	0.418

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Results and Conclusion

None of the hypotheses about the impact of the family on business success were confirmed by the ordinary least squares analysis. Although the variables CHOUSE (children in the household) and DHOUSE (dependent in the household) were found to be statistically significant at the five percent level, these variables were hypothesized to have an inverse relationship with business success, contrary to the positive relationship uncovered by the regression analysis. The five remaining family variables were found to have no statistically significant impact on business success.

Consistently however, no matter what "family" variable was used in the

regression equations, the variables ED (measuring educational attainment) and REG (government registration) had the hypothesized signs and were statistically significant. These results suggest that it is possible that, despite many of the survey respondents stating that their families contributed significantly to their success, the entrepreneur's skills (gained through education) and the business environment (operating a registered business in the formal sector) are more important determinants of success.

It is also possible that deficiencies in the data lie behind the failure to support the hypotheses. First of all, the dependent variable (SUCCESS) assumes a business is successful the larger it is (based on revenues earned and number of employees). The business's profit, for example, may be a better gauge of success, but none of the questions in the survey asked about this. Secondly, the purpose of the survey was to gain knowledge about the backgrounds of female entrepreneurs in Hanoi and to identify constraints on female entrepreneurs. While questions were asked about the entrepreneurs' families, the questions may not have been specific enough to gather data appropriate to testing the hypotheses about the influence of family on business success. Future research may involve searching for a survey that asks questions that pointedly focus on the role of the family in business success or conducting a new survey in Hanoi to elicit better information for testing the hypotheses.

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APPENDIX 1-SURVEY

An English copy of the survey used in this study is found below. There are five parts to the survey: Demography, Business & Entrepreneurship, Family Orientation, Opinion of Gender Roles, and Other Comments.

PART I. DEMOGRAPHY

1. What is your age? (Circle one)

   a. 18-30 c. 40-49 e. 60 or older
   b. 30-39 d. 50-59

2. What is your marital status? (Circle one)

a. Single d. Separated
b. Cohabitating e. Divorced
c. Married f. Widowed

3. Do you have any children? (Circle one)

   a. Yes
   b. No

4. **If yes** to question #3, how many children do you have? -
   _____

5. What is the age of your oldest child?
_____

6. What is the age of your youngest child?
_____

7. What is the highest level of education you have completed? (Circle one)

   a. Primary school d. Professional education (medical school, law school, etc)
   b. Secondary school e. No formal education
   c. University f. Other _____

8. What was your primary occupation immediately before you began operating your current business? (Check all that apply)

_____Attended school
_____Homemaker
_____Owned a different business
_____Was an employee of another business or government
_____Other (Explain:_____)

PART II: BUSINESS & ENTREPRENEURSHIP

9. How many hours do you work at your current business in an average day?
_____

10. How many hours do you work at your current business in an average week?
_____

11. Main product(s) of this business:
_____

12. For how many years have you owned this business?
_____

13. Is your business registered with the government? (Circle one)
    a. Yes
    b. No

14. Do you have any partners, that is, others who also own part of your business? (Circle one)
    a. Yes
    b. No

15. **If yes** to Question 14, how many partners do you have?
_____

16. Is this business operated from your home? (Circle one)
    a. Yes
    b. No

17. How many total employees do you have?
_____

18. How many paid employees do you have?
_____

19. How many unpaid employees do you have?
_____

20. How many family members are employed in your business?
_____

21. How many female employees do you have?
_____

22. Has the number of people your business employs increased over the last ten years? (Circle one)
a. Yes
b. No
Explain: _____

23. Most of the capital funds invested in your business comes from: (Check all that apply)
_____Personal savings or savings of partners
_____Family members
_____Bank
_____Other (Explain: _____
_____)

24. Which of the following sources of capital funds contributed the most to your business? (Check only one)
_____Personal savings or savings of partners
_____Family members
_____Bank
_____Other (Explain: _____
_____)

25. Estimated sales revenue (net income) in the last year:
_____ $0 - $1,000
_____ $1,000 - $5,000
_____ $5,000 - $10,000
_____$10,000 - $50,000
_____$50,000 - $100,000
_____$100,000+

26. What is the **major reason** you began operating your own business? Choose the <u>one option</u> that best fits your reasons.
_____Unemployed/lost my job
_____ I needed more income
_____ I saw a good opportunity
_____ I have good ideas and skills for operating my own business
_____ I did not have connections that would help me get a good job with a private or government entity.
_____Other (Explain:_____)

27. What were the challenges you encountered when you first began the business? (Check all that apply)
_____Lack of capital
_____Lack of "connections" (i.e. – networking or meeting other business owners)
_____Gender discrimination
_____Government constraints
_____Other (Explain: _____)

28. What are the main challenges you encounter while running your business now? (Check all that apply)
_____Difficulty in raising capital
_____Difficulty in making connections (i.e. – networking or meeting other business owners)
_____Gender Discrimination
_____Lack of business skills
_____Difficulty in managing employees
_____Lack of skilled employees
_____Government obstacles
_____Other (Explain: _____)

29. Do you think female entrepreneurs face more challenges than male entrepreneurs? Explain.

_____
_____
_____
_____

30. If you had not become a female entrepreneur, what would you have done? What are your alternatives?

_____
_____
_____
_____

PART III: FAMILY ORIENTATION

31. What is your husband's or partner's employment status? (Circle one)

a. Employed
b. Unemployed
c. Not in labor force
d. Not applicable (Unmarried, divorced, widowed, etc.)

32. Who makes the important decisions in your household? (Circle one)

a. I make the important decisions in the household
b. My husband/partner makes the important decisions in the household
c. Another elder male member makes the important decisions in the household
d. Another elder female member makes the important decisions in the household
e. My husband/partner and I equally make the important decisions in the household
f. Other family members and I equally make the important decisions in the household

33. How many people are there in your household in each of the following categories?
_____ Children (0 – 18 years old)
_____ Adults (18 – 64 years old)
_____ Elderly (65+ years old)

34. Do you have any say in how money is spent or used within your household? (Circle one)
    a. Yes
    b. No

35. Do you have any say in how to raise your children? (Circle one)
    a. Yes
    b. No
    c. I do not have children

36. How many hours do you spend on household work on an average day?
_____ 0 – 3 hours
_____ 3 – 6 hours
_____ 6 – 9 hours
_____ 9 – 12 hours
_____ 12+ hours

37. How many hours does your husband/partner spend on household work on an average day?

_____ 0 – 3 hours
_____ 3 – 6 hours
_____ 6 – 9 hours
_____ 9 – 12 hours
_____ 12+ hours

38. Does your family play a significant role in the success of your business? (Circle one)
    a. Yes
    b. No
Explain: _____
_____
_____

PART IV: OPINION OF GENDER ROLES

39. Do you think it is acceptable for women to participate in the government? (Circle one)

    a. Yes
    b. No
    c. Not sure

40. Do you think it is acceptable for a woman to earn more that her husband/partner? (Circle one)

    a. Yes
    b. No
    c. Not sure

41. Do you think it is acceptable for a woman to be more educated than her husband/partner? (Circle one)

    a. Yes
    b. No
    c. Not sure

42. Do you think it is acceptable for a woman to be the sole income earner of her family? (Circle one)

    a. Yes
    b. No
    c. Not sure

43. Do you think it is acceptable for a husband/partner to have the right to tell his wife not to work outside the home? (Circle one)

    a. Yes
    b. No
    c. Not sure

44. Should a wife be more responsible for housework than her husband if she works outside the home? (Circle one)

    a. Yes
    b. No
    c. Not sure

PART V: OTHER COMMENTS

45. Do you think you have become better or worse off since you started your own business? Explain.

_____

_____

_____

46. If you can, would you like to help other female entrepreneurs? And how would you help? Explain.

_____

_____

_____

47. What is your vision for your business in the long run? Explain.

_____

_____

_____

48. Is there any additional information you would like to share with us?

_____

_____

_____

We thank you for your time!