

# **Crosswalks to Prosperity**

**New Product Market Opportunities  
for Genesee Manufacturers**

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**January, 1990**

**Under a Sub-Contract from the  
Industrial Technology Institute,  
for a Contract from the  
Charles Stewart Mott Foundation**

## I. Overview

This report identifies new, attainable product markets for manufacturing establishments in Genesee County. The analysis uses a "crosswalk" method originally developed for the Michigan Modernization Service of the State of Michigan. The method pays close attention to the special marketing needs and production capacities of the threatened Genesee manufacturing base. The goal of this study is to pick a list of high growth manufacturing product markets that are feasible business opportunities - both in terms of technology and accessibility - for Genesee manufacturing establishments and firms. As explained below, the selection process concentrates on products classified generally as fabricated metal parts or simply assembled components and products. Most of these commodities are intermediate goods and capital equipment supplied to producers of "final-use" products whose markets have shown strong and consistent growth in the U.S. economy in the 1972-1986 period.

The analysis provides a framework for a manufacturing employment strategy that can mitigate a portion of the employment losses connected to potential General Motors disinvestment in the traditional manufacturing base of the Genesee County. The strategy promotes the development of long-term linkages to non-automotive U.S. manufacturing. This strategy can help Genesee employers and workers to participate in a variety of growth markets for manufactured goods in the U.S. economy. Lastly, such diversification will lessen Genesee's historical over-dependence upon auto manufacturing as both a source of employment and crucial export income.

### **Background**

Perhaps no other regional economy of its size in the United States has its economic fortunes so closely tied to a single industry -and a single company - as does Genesee County. This disturbing fact has been underlined in several recent studies of the county's economic base performed for the C.S. Mott Foundation. Genesee's overwhelming reliance upon auto employment has been responsible for the area's unmatched volatility in income and employment over the last twenty years. In recent years the level of GM area production and production have consistently decreased. At least one study forecast a permanent decline in area General Motors employment of 21,000-23,000, or more than one-third of 1986 GM employment, by the end of 1990. Since GM

employment has historically constituted more than 40% of all within-county employment, and even more important, well over 80% of all county manufacturing employment, the expected cutbacks will generate a staggering effect on the county's labor economy for years to come.<sup>1</sup>

Any viable plan to alleviate the effect of the GM disinvestment in the county's economic base, then, must try to replace the future loss of GM production with other forms of export manufacturing activity within the county. This necessary diversification would also dampen the wide swings in county economic activity tied so closely to the performance and restructuring of General Motors' North American automotive operations and sales. For example, the authors of the most sophisticated model of the Flint MSA's labor economy observed the following:

More rapid diversification (of the Flint MSA economic structure) to cushion against these volatile economic movements would need either some attraction of outside industry to widen a narrow industrial base, *or diversification by GM itself* (italics added).<sup>2</sup>

Results from this study can inform efforts to broaden the Genesee industrial base. The strategy does not rely on attempts to attract new firms or employers to locate within Genesee County. Instead, it is recommended that existing Genesee metalworking establishments refocus their marketing efforts from traditional automotive (and defense) products to a select list of the fastest and most consistently growing product markets in the United States. It is also strongly recommended in this report that Genesee's large, General Motors plants actively consider the partial use of their enormous production capacity to enter and supply many of the same market opportunities in the "new manufacturing" sector of the U.S. economy.

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1. The Michigan Employment Security Commission has most recently estimated a preliminary November, 1989 unemployment rate for Genesee of 11.6% (Michigan 6.9%). The average annual unemployment rate for Genesee in 1988 was estimated to be 14.2% (Michigan annual average rate of 7.6%). The possibility of more layoffs (especially at the remaining line in the CPC truck assembly plant) because of product changes and the strong prospect of a 1989-1990 auto recession is grounds for strong expectations of a return to high area unemployment rates in the first half of 1990.

2. Quote from Harold T. Shapiro and George A. Fulton. **A Regional Economic Forecasting System**. The University of Michigan Press, Ann Arbor, Michigan, 1985, p. 77.

## **The New Manufacturing**

The "new manufacturing" that is most beneficial for the Genesee economy is not related to product markets connected, even indirectly, to automobile manufacturing. Despite record total vehicle sales in the United States in recent years, sales of traditional domestic vehicles continue to fall because of incessant competition from foreign nameplate vehicles. Shipments of commodities from the U.S. motor vehicle industry - when measured in constant dollars - declined by 5.3% from 1978-1986.<sup>3</sup> Other basic U.S. manufacturing industries have suffered equal or greater declines in constant dollar shipments. Constant dollar shipments of fabricated metal products fell by about 2% between 1978 and 1986 while shipments of iron and steel products fell by an astounding 48%. Yet, many areas of U.S. manufacturing have shown growth. If shipments of motor vehicle and iron and steel products are excluded from total manufacturing shipments, the remainder of U.S. manufacturing shipments increased by 4.5% in constant dollars. A number of industries that produce "final-use commodities" - products that have passed through their final stage of processing - achieved percentage increases in output much greater than this level.

It should be remembered that both products and industries cycle through natural periods of expansion and decline. It is a critical task of those who manage manufacturing firms that produce intermediate goods and equipment to identify growth opportunities and avoid ebbing markets to ensure consistent health of their establishments. An important finding of this study is that the intermediate products of several metalworking industries in Genesee County figure prominently in the list of material requirements used by producers in many of the fastest growing product markets in the United States, or the "new manufacturing."

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3. Record levels of light vehicle sales were achieved in both of these years. Although 900,000 more light vehicles were sold in 1986 than in 1978 in the United States, almost 1.7 million fewer traditional domestic vehicles were produced and sold in 1986, as domestic market share fell from 84% in 1978 to 70% in 1986. Constant dollar shipments are said to have fallen by only 5% between over this period because of assessments of higher quality and value content for recent domestic vehicles by government analysts.

## II. The Structure of Genesee Manufacturing

The manufacturing sector in Genesee County clearly has a dual structure. On one side of the employment scale are at least eight, possibly twelve, very large General Motors facilities engaged exclusively in the production of motor vehicles and motor vehicle equipment and parts. The GM Public Relations office in Flint recently reported a December, 1989 total for company employment of 44,700.<sup>4</sup> This employment level is a serious decline from the 62,598 figure reported by GM Public Relations for December, 1985. GM employment still accounts for most manufacturing employment and income in the county, however, since the Michigan Employment Security Commission has recently estimated total manufacturing in Genesee also at a level of 44,700.<sup>5</sup>

Manufacturing in Genesee County, then, can be easily divided into two separate sectors: General Motors facilities and non-GM establishments. This reports treat each of these sectors separately in analysis. This report is restricted to GM plants or non-GM industries that are important components of Genesee manufacturing and for which enough information is available to run the analysis. It is important to gain some understanding of composition of the two manufacturing sectors in Genesee. An available source of employment and establishment count statistics by industry for Genesee is the 1986 (most recent) edition of the U.S. Census publication *County Business Patterns*<sup>6</sup>. The Census tabulated a total of manufacturing establishments in Genesee in March, 1986. Eight of these facilities reported employment of 1,000 or greater. It is safe to assume these plants are GM

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4. Reported to OSAT/UofM at the request of this author and others of the staff.

5. Preliminary estimate. Considerable GM employment is placed by the MESC in sectors outside of manufacturing. For a detailed discussion of the Flint MSA labor economy and the role of GM employment, see "Chapter Four: The GM Impact Upon the Genesee Labor Economy," in D. Cole, M. Flynn, S. McAlinden, and D. Andrea. *The Automotive Industry, General Motors, and Genesee County. A Report Prepared For The Charles Stewart Mott Foundation, Flint, Michigan. University of Michigan, Ann Arbor, December, 1987. pp.174-240.*

6. U.S. Bureau of the Census, *County Business Patterns, 1986. Michigan U.S. Government Printing Office, Washington, D.C., 1988.*

establishments or complexes. No establishments were listed that had between 500 and 999 employees, and 293 establishments were listed as using between 1 and 499 employees. Manufacturing establishments that use less than ten employees will not be considered in this report on diversification. The size of such small establishments are assumed to restrict their flexibility in production. Thus, 148 facilities with employment between 10 and 499 are identified as potential crosswalks clients .

Facilities of this size have been labeled as "foundation firms," or closely held "small-to-medium" establishments that produce important tooling and intermediate goods and provide the necessary infrastructure for several of the largest manufacturing industries. Of these 148, about 86 fall into standard industrial classifications (SICs) connected to the production of commodities that involve metalworking. The foundation firm concept applies particularly well to metalworking firms and the major data base used in this study.

A breakout of metalworking foundation firm establishment counts by two-digit Standard Industrial Classifications are shown in Table 1. Only two sectors contain ten or smaller-to-medium establishments according to the 1986 *County Business Patterns*. 28 small-to-medium establishments are listed in the metal fabricated products sector (SIC 34). Two 3-digit industry groups, within the SIC 34 sector, contain more than 5 appropriately sized facilities: fabricated structural metal products (SIC 344) and screw machine products (SIC 345). The last named industry group is selected as a client Genesee industry for this report. *County Business Patterns* tabulated 37 facilities located in the non-electrical machinery (SIC 35) sector in Genesee. Seventeen of these establishments were located in the metalworking machinery and equipment industry group (SIC 354). All of these facilities were coded as being producers of machine tooling and equipment such as dies, jigs, fixtures and gages (SICs 3544 and 3545). Ten facilities were listed in the miscellaneous equipment industry group (SIC 359). Although firms in this industry group do produce various engine parts and components (SIC 3592), others make or service a wide variety of components and equipment for many uses. Facilities located in the industry groups, SICs 354 and 359, were also selected as client industries for this report.

Table 1

Structure of "Foundation" Establishments in Genesee

<u>SIC</u>	<u>Industry Description</u>	<u># of Establishments</u>
33	Primary metals	3
34	Fabricated metal products	28
	342 Miscellaneous hardware	3
	344 Fabricated structural metals	7
	345 Screw machine products	7
	346 Metal forgings	5
	347 Metal services	3
	349 Miscellaneous metal products	3
35	Machinery, excluding electrical equip.	37
	353 Construction machinery	3
	354 Metalworking equipment	17
	356 General industrial equipment	3
	359 Miscellaneous equipment	10
36	Electrical equipment	5
37	Transportation Equipment	6
39	Miscellaneous manufacturing	4
Total		86

The importance of maintaining the business viability of the GM plants is not open to question. The present and future role of Genesee's non-GM manufacturing sector, however, should also be stressed. In particular, Genesee's independent machine tool and metal fabricated industries must be quickly connected to alternative product lines to replace the likely loss of local auto business. Genesee's independent machine tool industry is very small in comparison to that represented in other regional manufacturing economies of the same size as the Flint MSA. The U.S. Census publication *County Business Patterns* estimated the 1986 total employment in this crucial support sector in Genesee at about 481, located in 24 establishments. The small relative size of Genesee's machine tool industry multiplies the importance of these establishments that Genesee does contain. These establishments will not only face a critical challenge in the loss of a traditional source of their business, but also a one-time important opportunity to employ a large number of former skilled GM machinists and other journeyman. Whether this opportunity can be used to meet the future challenge will depend directly upon the product and market mobility of these firms. The retention and expansion of Genesee's current machine tool industry

will play an important role in any effort to attract new metal-working production establishments to the local area.

To summarize, three client industries from Genesee's non-GM manufacturing base are selected for the diversification analysis described in this report. They include Screw Machine Products (SIC 345), Tool, Die, Jigs and Fixtures, and machine tool accessories (SIC 354), and Miscellaneous Machinery (SIC 359). In addition to these small firm sectors, an attempt is made to assess the likely potential of various GM facilities for non-automotive production.



### III. Method

Two essential questions need to be answered for both individual Genesee manufacturing establishments and community economic planners. The first question is demand or market-oriented: Given patterns in U.S. market demand for end-use manufacturing commodities: **what should be produced in Genesee?** The second question is supply- or technology-oriented: Given current county endowments of labor skills and manufacturing capital, **what can be produced?** Many Genesee manufacturers have had little experience in answering these questions outside of the context of a narrow range of goods and services produced for the automobile industry. These manufacturers are now faced with the necessary task of simultaneously answering the two questions above without the necessary experience and information to do so.<sup>7</sup>

This section briefly describes the methodologies used for selecting high opportunity product markets and the matching of these markets with Genesee's manufacturing base.

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7. See, for example, the fascinating results regarding the marketing experience of Genesee firms described in Mary L. McLean, *Strength and Weaknesses of the Genesee County Business Environment, A Report for The Charles Stewart Mott Foundation*, N.C.I. Research, The Institute for Urban Economic Development Studies, Evanston, August, 1988.

8. There are the two remaining types of broad manufacturing product categories in terms of production requirements. *Complex Assembled Components* are intermediate goods such as electric motors or internal combustion engines. *Complex Assembled Products* are end-use goods such as aircraft or electronic computers.

9. U.S. Department of Commerce, Bureau of the Census, *Annual Survey of Manufactures. Product Shipments, (AS)-2, 1958-1986*. 1986 was the most recent year for which reliable product shipments data could be acquired, until the publication of the preliminary results of the 1987 Census of Manufacturing. Numerous attempts were made to acquire these preliminary results before the scheduled release date of September, 1989. The efforts were unsuccessful.

10. Harry M. Markowitz, and Alan J. Rowe. *Studies in Process Analysis*. John Wiley and Sons, New York, 1963, p.276.

## What should be produced?

This report assumes that Genesee metalworking firms can successfully enter two types of product markets:

*Fabricated and Simply Assembled Products* or end-use products of a simple nature not involving a large number of levels of assembly or incorporating complex components (e.g. snow shovels, stamping dies, metal cans).

*Fabricated Parts and Simply Assembled Components* or simple intermediate products such as metal stampings, valves or fittings; and metalworking services such as galvanizing, electroplating, machine shop and sheet metal work.

End-use products are defined as products sold in final use form to either consumers or industrial-commercial establishments. Intermediate products are commodities destined for use as components or materials in larger more complex products. It is assumed that Genesee manufacturers can not easily enter new (for them) markets for complex components or products.<sup>8</sup> Genesee manufacturers may be successful, however, at penetrating new markets for relatively simple goods. It is assumed that demand by consumers and commercial customers for end-use goods generates, by definition, demand for intermediate goods. A major task of this study, then, is to identify high-growth opportunity markets for simply assembled final use goods and simple intermediate goods destined for use in complex products.

## Market Selection Analysis

The selection of end-use product markets for recommendation to Genesee manufacturers, either for direct entry or the supply of needed intermediate goods, requires a reliable data base on product market shipments over time, and a screening methodology to rank these markets in terms of acceptable characteristics. The chosen data base is the U.S. Census's *Annual Survey of Manufactures Value of Product Shipments* series.<sup>9</sup> A computer tape was acquired from the U.S. Department of Commerce, that contained 5-digit level annual shipments data for almost 1,700 product groups in manufacturing for the period 1958-1986. The tape also contains a matching series of price deflators

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that are used to convert current dollar shipments to constant (1982\$) values in analysis.

The overall analysis concentrates on identifying four types of potential high growth markets for Genesee manufacturers:

•*End-use markets for direct entry.* These include simple end-use product markets within Genesee manufacturers current industrial classifications. Few of these markets are expected to be identified in the analysis.

•*End-use markets for crosswalk entry* These include simple end-use products located outside the Genesee manufacturers current classification for which the technical capacity exists for production and market entry..

•*Linked supplier markets for direct entry.* These include markets for metal-working intermediate goods that are directly linked to the production of identified fast-growing end-use products. The intermediate goods are those produced in the Genesee manufacturers current industries.

•*Linked supplier markets for crosswalk entry.* These include intermediate goods linked to the production of fast growing production of final-end use goods. However, the intermediate goods identified are those normally produced outside of the Genesee manufacturers current industries, but for whom the technical capacity exists for entry.

### **The "End-Use" Markets**

A special screening process is employed in selecting fast-growing, end-use product markets. The 1,700 5-digit product markets in the USDOC analysis set are first screened for a variety of characteristics. First, only end-use products are considered. Second, these end-use products must either directly or indirectly require-- in supply -- metal-working services or products in production. Finally, automotive products are deliberately excluded from analysis. While this last screen is relatively easy to effect, the first two criteria are more difficult. A recommended list of appropriate 3-digit product groups that include most of the final-use metal-working products manufactured in the United States is used in this screen. The original model on which the

Crosswalks concept is based is taken from the work of two Yale industrial economists in the early 1960s: H.M. Markowitz and A.J. Rowe. These two researchers published their work in 1963 and included the following end-use table reproduced in table 2.<sup>10</sup>

Table 2

3-Digit End-Use Product Markets

<u>SIC</u>	<u>Product Description</u>
<i>Type 1</i>	<i>Simple Assembly</i>
2514	Metal household furniture
2522	Metal office furniture
2542	Metal Partitions and fixtures
2591	Drapery Hardware and blinds and shades
341	Metal cans and shipping containers
342	Cutlery, Handtools, and general hardware
343	Heating Equipment, except electric and warm air; and plumbing fixtures
344	Fabricated Structural metal products
347	Coating, engraving and allied products
348	Ordnance and accessories, except vehicles and guided missiles
349	Miscellaneous fabricated metal products
3914	Silverware and plated ware
3949	Sporting and athletic goods, n.e.c.
3946	Needles, pins and fasteners
<i>Type 2</i>	<i>Complex Assembly</i>
2451	Mobile homes
352	Farm and garden machinery
353	Construction, mining, and materials handling machinery and equipment
354	Metalworking machinery and equipment
355	Special industry machinery
357	Computer and office equipment
358	Refrigeration and service industry machinery
362	Electrical industrial apparatus
363	Household appliances

365	Household audio and video equipment
366	Communications equipment
369	Miscellaneous electrical machinery, equipment and supplies
372	Aircraft and parts
373	Ship and boat building and repairing
374	Railroad equipment
375	Motorcycles, bicycles, and parts
379	Miscellaneous transportation equipment
381	Search, detection, navigation, guidance, aeronautical, and nautical systems, instruments and equipment
382	Laboratory apparatus and analytical, optical, measuring, and controlling instruments
384	Surgical, medical, and dental instruments and supplies
385	Ophthalmic goods
386	Photographic equipment and supplies

The product industry groups displayed in table 2 are split into two groups, simply assembled products and complex assembled products. The list is slightly modified to reflect the creation of several new product groups that have appeared since the early 1960s, and to exclude several groups that have disappeared since that time. The 36 product industry groups contain a total of 421 separate 5-digit product groups which are grouped into 110 4-digit industries.

The "end-use" market selection analysis is focused on constant dollar shipments for these 421 product groups during the 1972-1986 period. A series of trend and percentage change analyses are applied to this data. A major goal is to select a reasonable number of separate markets yet still ensure the presence of strong growth characteristics for various periods during 1972-1986. For these purposes, the following criteria were developed and applied:

1. Constant dollar shipments must have grown at an average annual rate, corrected for fluctuations in Gross National Product, of greater than or equal to 2% during the 1972-1986 period. Such markets would display long term, consistent growth above that of U.S. manufacturing as a whole.
2. Constant dollar shipments of the product group must have increased in absolute percentage terms by 8% between 1978 and 1986. Corrected

trend analyses were applied to each of the shipment series. Since 1978 was a peak constant dollar shipments level for many end-use goods in the United States, the selection of markets that have grown since that time would ensure the avoidance of markets that are still below historical levels of industry capacity.

3. Constant dollar shipments must have increased in absolute percentage terms between 1982 and 1986. In other words, the size of the product market must have increased since the 1982 recession .

4. Finally, the size of the product group market in 1982\$ must have been at least \$100 million in 1986. Smaller markets are unstable and may not yet possess sufficient depth for new entrants.

Several additional screening criteria are applied to produce the final selections. Markets heavily affected by import competition in recent years are generally avoided as are defense related markets.<sup>11</sup>. Markets related to 4-digit SIC industries where the ratio of "value-added" to "value shipped" has declined in recent years are generally emphasized in selection. It is felt that this pattern indicated a trend in the rate of "outsourcing," with positive implications for supplier industries connected to the production of such products. Finally, some analysis of the movement in product price indexes during the 1987/1 through 1989/1 period is attempted. It was felt that recent price movements for the various product markets provide a final check on recent market growth and capacity levels.

Table 3 displays the final list of end-use product markets identified for this study. The 67 5-digit product markets make up almost 16% of the 421 end-use metalworking product markets considered in the trending analysis and about 4% of the 1,600 5-digit product markets in U.S. manufacturing. The U.S. Census estimated that about \$223 billion worth of shipments were in the form of these products in 1986, or about 10% of total manufacturing shipments in the United States that year. About half of these shipments in table 3 are located in the eight product groups related to the electronic computing equipment and aircraft industries. For the 1972-1986 period, the average rate of annual growth in constant dollar shipments for the 67

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11. It was felt that new entrants would not fare well in markets facing significant import competition. Defense related products are notoriously unreliable in trend analysis and were avoided for this reason.

products markets is over 10%. This growth rate should be contrasted with a comparable figure of 2% for all of manufacturing and negative growth for automotive and iron and steel products. As a final check on their current viability, producer price index values were tabulated for these 5-digit product categories for the January, 1987-January 1989 period. On average, the producer price index for the selected 67 products increased by 9.8% per year. The comparable figure for all U.S. manufacturing products was less than 5% per year, a growth rate exceeded by every product listed in table 3. A rate of producer price increase twice the average rate for all products is strong evidence that the growth characteristics of the selected products have remained strong.

Table 3

Fast Growing Product Markets

1986: <u>Fast Growing Product Markets (SIC)</u>	1986 Market Value: <u>\$millions</u>	Market <u>Growth</u>
Metal office seating, incl. upholstered (25221)	1,115.10	7.00%
Office storage units, files, and tables (25223)	1,292.70	3.50
Other metal office furniture (25224)	1,804.70	15.80
Partitions, shelving lockers, and fixtures (25420)	215.00	3.10
Partitions, except wood (25421)	266.90	2.90
Fixtures for stores, banks, etc. (25420)	866.40	4.60
Venetion blinds (25912)	612.90	15.40
Metal cans, n.s.k.	174.50	3.10
Aluminum cans (34112)	5,459.20	11.00
Metal doors and frames (ex. storm doors)(34421)	2,774.40	2.60
Metal window sashes, frames (ex. storm) (34422)	1,815.90	2.60
Other sheet metal work (34446)	4,118.30	2.10
Prefabricated metal buildings, n.s.k. (34480)	205.80	18.30
Prefab. metal industrial & commercial bldgs. (ex. farm & residential) (34481)	1,886.30	6.60
Noninsulated ferrous wire rope, cable, etc., not produced by wire drawers (34961)	455.10	6.80
Laminated aluminum foil flexible (34481)	877.60	4.00
Construction machinery, n.s.k. (35310)	408.20	8.40
Industrial trucks and tractors, n.s.k. (35370)	242.80	3.60
Binding machinery and equipment (35554)	160.20	5.40
Other printing trade machinery and equipment (35555)	3,813.00	6.90
Electronic computing equipment, n.s.k.(35730)	1,311.10	41.00
Electronic computing equipment (35731)	19,959.10	34.90
Peripheral equipment for computers (35732)	17,222.90	30.60
Parts and attachments for computers (35733)	10,187.30	30.60

Mailing, letter handling, addressing machines (35795)	801.30	6.70
Parts for automatic merchandise stores (35812)	167.90	2.40
Unitary air conditioners (35852)	3,320.40	2.70
Commercial refrigeration equipment (35853)	1,668.80	2.70
Commercial cooking and foodwarming equipment (35891)	924.20	4.30
Commercial and industrial vacuum cleaners (35893)	279.50	7.10
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	136.40	15.70
Household laundry equipment, n.e.c. (36333)	405.30	2.20
Electric razors and dry shavers (36342)	1,934.80	18.50
Parts for small appliances (36344)	232.80	2.20
Household vacuum cleaners, parts and attachments (36350)	1,287.80	3.10
Household water heaters, electric (36391)	417.60	4.00
Household water heaters, except electric (36392)	558.10	2.60
Radio and TV receiving sets, n.s.k. (36510)	279.80	14.20
Telephone switchboard equipment (36611)	7,315.20	6.90
Communications systems and equipment (ex. broadcasting) (36621)	11,133.80	9.70
Search & detection, navigation & guidance systems (36625)	30,054.60	8.50
Electronic systems and equipment, n.e.c. (36627)	3,844.50	7.70
Ignition harness and cable sets (36941)	757.30	3.60
Other electrical equipment for internal combustion engines (36945)	2,575.80	4.70
Electrical equipment, n.e.c., n.s.k. (36990)	322.70	7.20
Military aircraft (37211)	17,727.50	5.30
Civilian aircraft (37212)	12,334.40	8.90
Aircraft engine parts & accessories (37281)	8,683.10	4.20
Aircraft parts & accessories, n.e.c. (37281)	16,707.10	5.20
R. & D. on aircraft parts (37281)	2,427.40	13.30
Aircraft propellers (37285)	297.50	2.90
Inboard motorboats (37325)	1,002.10	2.50
Inboard-outdrive boats, except houseboats (37326)	1,156.20	6.10
Golf carts and industrial personnel carriers (37993)	267.50	5.90
Aeronautical, nautical & navigational instruments (38111)	2,210.10	3.30
Testing equipment for electrical circuits & motors (38292)	756.40	8.80
Aircraft engine instruments, except flight instruments (38291)	534.00	9.00
Physical properties testing and inspection equipment (38292)	756.40	8.80
Sighting & fire control equipment (38322)	531.70	14.20
Analytical and scientific instruments, except optical (38323)	2,936.20	25.90
Surgical appliances and supplies, n.s.k. (38420)	310.90	20.00
Surgical appliances and supplies (38421)	5,676.10	8.30
Electronic hearing aids (38424)	210.00	7.20
Ophthalmic focus lenses, including contact lenses (38512)	738.60	4.90
Prepared photographic chemicals (38618)	1,160.20	6.80
Golf Equipment (39492)	856.10	6.10



Playground, gymnasium, and exercise equipment (39494)	570.90	8.60
<b>Total Market</b>	<b>223,514.4</b>	

## Related Supplier Markets

A second major stage in the market analysis is the identification of significant supplier markets related to the fast growing "end-use" markets listed in table 3. Of great interest in this study are supplier markets for metalworking goods that are produced or capable of being produced by Genesee manufacturers. This study makes extensive use of the National Input/Output Accounts matrix supplied by the U.S. Department of Commerce's Bureau of Economic Analysis. This source of information is used to estimate "linked" supplier markets connected to the 67 end-use markets chosen through the trend analysis. Roughly \$100 billion of the \$223 billion in product shipments listed in table 3 are broken out into related intermediate good supplier markets.<sup>6</sup>

A direct example is presented of how the I/O accounts information can be used to define supplier markets for Genesee manufacturers. Shipments of electronic computing equipment (SIC 35731) totaled \$20.0 billion in 1986. At the same time shipments of peripherals and parts and attachments for such equipment amounted to an additional \$27.3 billion. The supplier requirements for the overall industry, SIC 3573, are calculated in the I/O accounts as shown in table 4. Dollar amounts of required shipments are computed directly from the shipments levels displayed in table 4 and the "dollars of supply per \$100 of Output listed in table 4. For example, 1986 shipments of computer peripherals totaled \$17.2 billion in 1986. According the I/O information contained in table 4, about \$.92 of sheet metal work supplied in the form of products from SIC 3444 and \$.86 supplied in the form of products from SIC 3465 (automotive stampings) were required to produce each \$100 of computer peripherals. In 1986, these two

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12. It is interesting to note that the \$100 billion figure for identified supplier markets in this study exceeds by some \$11 billion the level of estimated shipments of automotive parts and stampings forecast for 1989 by the U.S. Department of Commerce. See 1989 U.S. Industrial Outlook. U.S. Department of Commerce, International Trade Division.

supplier markets can be estimated at \$158.4 million (SIC 3444) and \$148.1 million (SIC 3465) respectively. The two *first tier or direct* markets are described correctly in following manner:

•\$158.4 million of sheet metal products from SIC 3444 supplied to producers of computer peripherals, SIC 35732.

•\$148.1 million of automotive stampings products from SIC 3465 supplied to producers of computer peripherals, SIC 35732.)

Table 4

Percentage Distribution of Intermediate Inputs by  
Industry  
for Electronic Computing Equipment (3573)

<u>Major Suppliers of Intermediate Inputs (SIC)</u>	<u>\$ of Supply per \$100 of Sales:</u>
Electronic computing equipment 3573	18.48903
Semiconductors & related devices 3674	5.48551
Electronic components, n.e.c. 3679	3.63217
Miscellaneous plastic products 307	1.64459
Industrial controls 3622	1.30147
Sheet metal work 3444	.91979
Nonferrous wire drawing & insulating 3357	.86160
Automotive stampings 3465	.75302
Electronic connectors 3678	.63756
Motors & generators 3621	.62201
Electrical industrial apparatus, n.e.c. 3629	.50411
Switchgear & switchboard apparatus 3613	.47236
Calculating and accounting machines 3574	.44495
Petroleum refining 2910	.39579
Metal stampings 3469	.34534
Aluminum castings 3361	.32348
Coating, engraving, and allied services, n.e.c. 3479	.29445
Screw machine products, bolts, nuts 3450	.27964
Plating & polishing 3471	.27919
Fabricated metal products 3499	.25167
Electronic capacitors 3675	.25021
Paperboard containers and boxes 2650	.24563
Special dies, tools, jigs and fixtures 3544	.23842
Nonelectrical machinery, n.e.c. 3599	.21802
Electronic coils transformers 3677	.21334

Aside from their size, these direct supplier markets manifest two important characteristics. First, they represent true supplier markets. The shipments of sheet metal work and stampings to makers of computer peripherals are sourced from independent suppliers outside of the computer peripheral and equipment industry, SIC 3573. Second, the two markets may well be the fastest growing markets for sheet metal and stampings products in the United States today. Although the total market for automotive stampings in 1986, was almost \$15 billion, the strict auto related portion of this market is expected to grow at less than a 1% annual rate through the end of the century, or fifteen times, at least, slower than the market or computer related stampings. In addition, much of the auto-related market is dominated by in-house, captive stamping operations. This may not be generally true of the stamping markets related to computer products or other end-use products listed in table 3.

The study has also identified another type of supplier market at the second tier of supply to end-use products. For example, a large first-tier supplier market related to computer peripheral products are intermediate goods supplied from the electronic components industry, SIC 3679. In 1986 this market amounted to \$625.6 million of electronic components supplied to makers of computer peripherals equipment. Yet makers of electronic components products also rely on the output of other industries. Table 5 lists the major contributors of required intermediate goods used in the production of electronic components, n.e.c. products. A series of *second tier or indirect supplier markets* related to the production of computer peripheral products can be described and estimated. In the case of electronic components, for example:

- \$3.75 million of automotive stampings products (SIC 3679) supplied to producers of electronic components (SIC 3679) supplied to makers of computer peripherals equipment (SIC 35732).

- \$1.25 million of sheet metal products (SIC 3444) supplied to producers of electronic components (SIC 3679) supplied to makers of computer peripherals equipment (SIC 35732).

Total shipments from the sheet metal product producers destined for use in the production of peripheral equipment for computers in 1986 were comprised of the the \$158.5 million in direct shipments and additional amounts shipped to other direct suppliers who in turn supplied end-use peripheral equipment makers. The \$1.25 million

shipped to electronic component producers comprises only a fraction of the second-tier sheet metal products market related to SIC 35732.

This study set certain guidelines in identifying potential supplier markets related to the end-use product markets listed in table 3. Only markets of at least \$100,000 in size were identified. Only product markets that constituted at least .01% of required input for a specific end-use product were identified. Finally, only markets related to potential metal-working intermediate goods in the following 2-digit product sectors were defined: SIC 33 or primary metals; SIC 34 or metal fabricated goods; SIC 35 or nonelectrical machinery; SIC 36 or electrical machinery; SIC 38 or instruments and related goods; and SIC 39 or miscellaneous manufacturing. Even so, the study has identified a total of almost 30,000 supplier markets directly or indirectly related to the end-use goods listed in table 4. These markets total over \$50 billion in 1986 shipments and represent the fastest growing set of metalworking related supplier markets in U.S. manufacturing.

### What Can be Produced?

The market selection analysis identifies *direct entry* markets for Genesee manufacturers within their current industrial classifications. This assumes that these producers possess the flexibility to at least produce similar products to those manufactured in the past; and can sell this output to new, non-traditional customers.

The major goal of the Crosswalks method, however, is to identify opportunities for Genesee manufacturers to "cross" or switch industries -- in terms of output -- to produce goods dissimilar to those produced before for a range of customers in new markets. An automotive stamper, then, may not be limited to considering entry into markets that involve only automotive stampings products, but perhaps can actively consider markets related to metal or other metal fabricated products. The potential to enter markets located in other industries depends, it is assumed, upon the technical capacity and potential flexibility possessed by the individual establishment. A flexible, capable firm can consider *crosswalk entry* markets in addition to traditional *direct entry* markets. This special ability increases many fold the number of product market opportunities for active consideration. Before new industrial markets are recommended to individual Genesee manufacturers, however, an assessment of how well these establishments match needed production requirements in the

new, target industries is performed. The method used in this study is machine tool requirements analysis.

The logic of the machine tool requirements method rests upon the assumption that efficient or required technology to produce a given product can be estimated solely through an analysis of the inputs used in actual production. Machine tool usage estimates, in particular are stressed in this model along with the scale of production. A special database of establishment machine tool endowments by specific industry and size of facility is needed to perform the comparative analysis. The *American Machinist 13th Inventory of Metalworking Equipment* (AM Inventory) was acquired from the new owners of the *American Machinist Magazine* for this purpose.

The AM Inventory contains 11,551 responses to a 1983 survey of the of metalworking establishments carried out by the *American Machinist* magazine. The AM Inventory is recognized as the best available source on machine tool use in metalworking industries in the United States, both in terms of detail and in terms of overall representation at the national, state and industry levels. The average responding facility reported the use of 21 different types of machine tools. The AM Inventory measured counts and ages of 173 different types of machine tools grouped into 52 categories located in four major varieties of metalworking equipment: metal-cutting machines, metal-forming machines, joining and assembly equipment, and other types of industrial equipment. Cases representing over 180 separate 4-digit SIC industries - based on reported primary product - were collected. Over 120 of these industry sub-samples contained 15 or more complete records.

The requirements analysis involved the matching of separate industries with each other on the basis of their relative use of the 173 specific machine tools. A special feature of the comparative analysis is matching of individual establishments in terms of technical use of machinery with over 180 metal-working industries. "Relative closeness" is determined on the basis of a "distance" score ranked against the establishment's similarity to it's own "home" or current product industry. "Close" industries, then, can be recommended to client Genesee establishments for entry. Clients are informed of not only their own first and second tier market opportunities, but also those of industries in which feasible entry has been determined. This process can best be described through an examination of the actual Crosswalks

results for the two types of Genesee manufacturers considered in this study.

## IV. Crosswalks for Genesee GM Facilities

### GM's 3 for 4 Position

General Motors has lost almost 25% of its share of the U.S. passenger car market since 1978.<sup>13</sup> In fact, GM's share loss now comprises most of the domestic market share loss suffered by the U.S. motor vehicle industry since 1978. It is clear that significant losses of market position to import competitors in 1978-1982 period by Ford and Chrysler have been shifted to General Motors in the 1983-1989 period when these two American competitors improved their share at practically the sole expense of the GM car divisions.

Individual GM plants face serious challenges because of the loss of market position by the corporation. In 1978, GM produced almost 6.9 million light vehicles in the United States. In 1989, the corporation produced only 4.7 million vehicles in this country or about 68% of the 1978 total. During the same period there was some further loss of internal corporate production to increased outsourcing. These changes in U.S. production lead to an obvious conclusion regarding the relative positions of GM's U.S. vehicle plants: **The corporation needed less than 68.2% of its 1978 capacity to achieve its 1988 level of U.S. production.** This disparity - between potential capacity in existing plants and actual production - is the source of the famous "overcapacity problem" responsible for GM's weak, high manufacturing cost position in the domestic motor vehicle industry. Although the corporation closed a number of assembly, component and parts plants in the 1980-1987 period, it also built a number of assembly plants and invested over \$60 billion on new plant and equipment for the purpose of improving potential productivity. The overcapacity problem still exists and can be traditionally solved in one of two ways: dramatically increased sales of U.S. produced vehicles, or further plant closings. The prospect of a 1990 model year sales downturn almost guarantees the occurrence of the second option in the near term future.

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13. GM's share of new car sales has declined from an annual level of over 47 % in 1978 to a level of 34.7% in 1989. In fact the U.S. market share for UAW/CAW built (not counting NUMMI vehicles) was only 32.3% in 1989. See Figure 1 for GM auto market share changes since 1978..

Figure 1

"Traditional Built"  
U.S. Auto Market Share

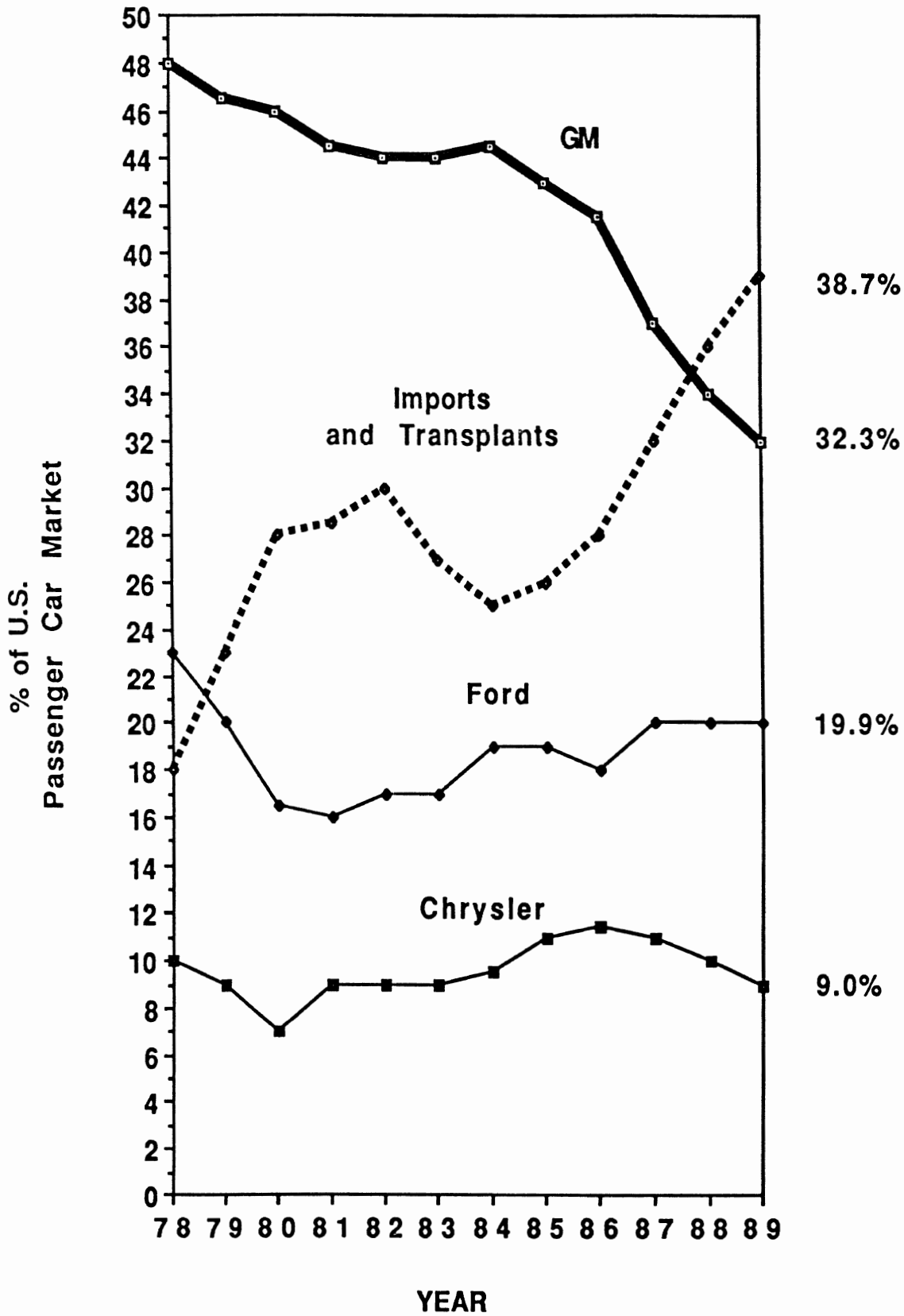
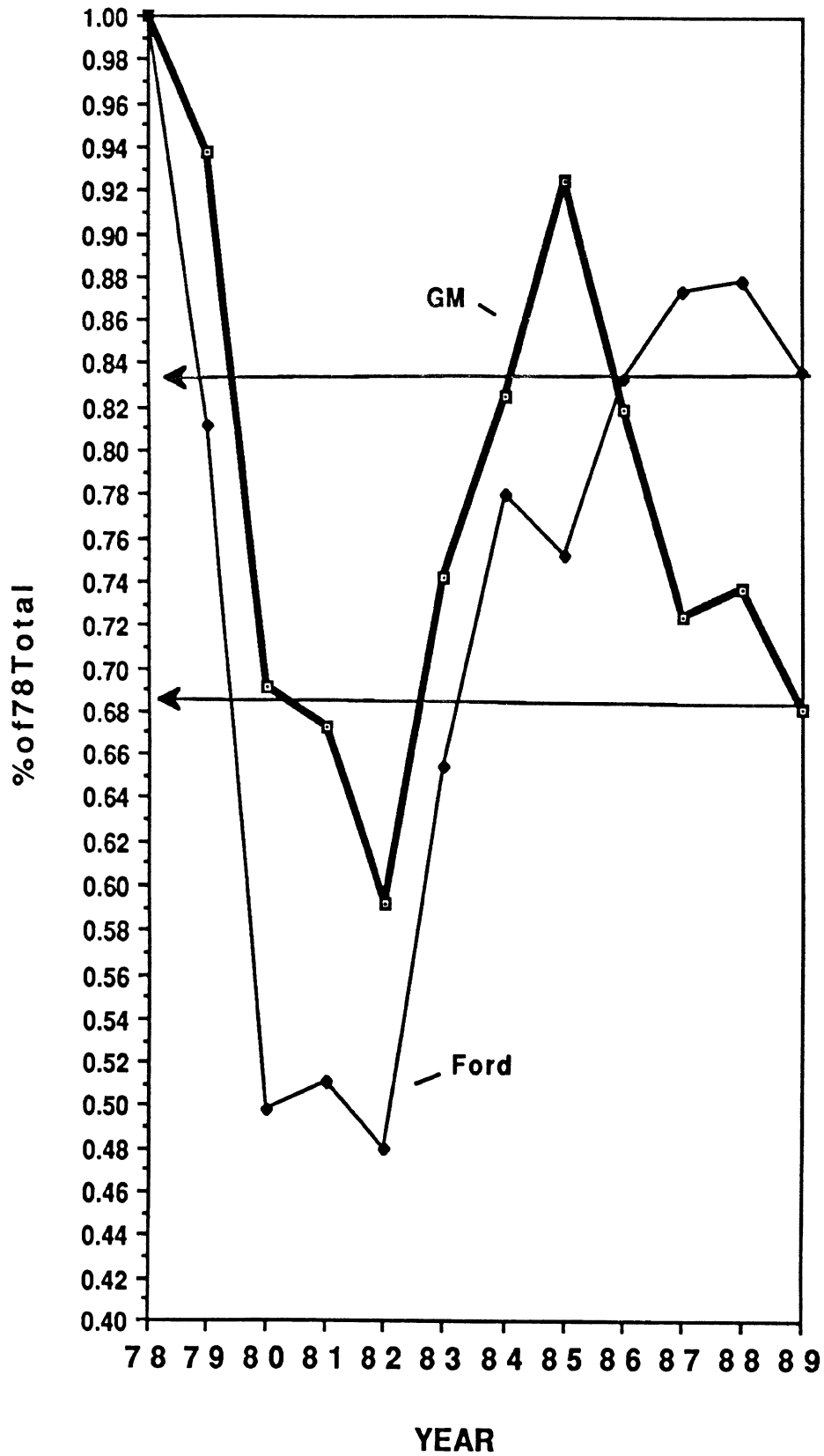




Figure 2  
 2 for 3?  
 GM/Ford U.S. Production  
 As a % of 1978



An important characteristic of GM's North American vehicle manufacturing system is that at least two plants are available to produce similar parts, components or vehicles in the company's product mix. Indeed, in a number of cases three, four, or even five plants are available to carry out the same work. In rare cases where only one captive (internal) plant is available to produce a given product, there is usually a competing external supplier. The special meaning of the overcapacity problem for individual plants is linked to the nature of plant operations in the U.S. motor vehicle industry. Most GM plants are built to operate optimally with two full production shifts (and perhaps a third "maintenance" shift). Four shifts of potential capacity exist then if two plants are available to produce the same output.

Yet the special nature of GM's overcapacity problem makes evident that, on the average, only three shifts of work are needed from each four shifts of capacity, or "3 for 4."<sup>14</sup> In the case of two competing plants, one plant will run effectively with two shifts, while the other plant will operate at high variable cost with one shift. In the case of three or more available plants, it is almost always true that at least one plant is quickly idled. The typical pattern in the case of two plants is that both will remain operating allowing the corporation to "whipsaw" one plant against the other for the extra shift or the promise of future new product. Eventually one plant will be selected to run at full capacity and the remaining shift of work outsourced or made unnecessary by reduced output of new products.

Many factors have been described by various auto production analysts as critical in the decision process connected to plant choice. All of these observers agree that relative unit cost performance is an important, if not the most important, criterion used to select "winners" from a number of available facilities.<sup>15</sup> If a typical plant is only

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14. Some auto analysts worry that the 1990 model year will be marked by a significant downturn in sales. U.S. production of GM light vehicles may fall from their current annual level of 4.7 million, then, to 4-4.5 million. The overcapacity ratio may fall to almost "2 for 3" The corporation, however, is not expected to reduce permanent capacity to anywhere near this reduced level since sales are expected to rebound in the 1991-1993 period. Much depends, however, on the share performance of imports and Ford during the expected downturn.

15. For a recent review of plant selection criteria, see Jim Harbour, "Selecting the Right Plant," *Automotive Industries*, April, 1989, p.9.

operating one shift, it will find it almost impossible to compete with a similar plant operating at full utilization. Simply put, not enough output is being produced in the one-shift plant to lower levels of capital, indirect and salaried labor costs to competitive levels. A number of Genesee GM facilities have been placed in this position in the past and several may find themselves in this situation in the near future. Since competition for new and existing product between GM plants in the 1990s will depend to a great extent on current relative performance, it is critical that means are found to boost the operating rates of underutilized Genesee plants.

Three such means may exist. First, local plants may capture new product within the GM system that are connected to the introduction of several new and hopefully successful model introductions. Second, local plants could acquire auto related contracts from other motor vehicle producers here in the United States or overseas. The acquisition of non-GM automotive contracts is reputedly a signal of high distinction in the relative rating of plants within and between divisions.<sup>16</sup> Non-GM automotive contracts are highly regarded by plant evaluators, especially contracts from Japanese transplant facilities, since they are positive evidence of plant competitiveness as determined by other motor vehicle manufacturers.<sup>16</sup> Third, local plants could secure non-automotive contracts or work from major producers of other final-use goods whose part and component requirements are similar to that of the motor vehicle industry. Any of these alternatives would directly improve plant operating performance by raising utilization rates. Outside contracts can generate low operating profits, yet still dramatically improve plant performance in terms of traditional output. All three alternatives are positive signals of plant flexibility and capacities for market awareness, engineering and labor force skills. Only the third alternative, however, can serve as a counter-cyclical cushion to the vagaries of the overall market for motor vehicles. It is the third alternative that this report is meant to directly address.

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16. The first two automotive alternatives are being investigated by M. Flynn and D. Andrea of the University of Michigan's Office for the Study of Automotive Transportation in their study of potential new automotive parts and component markets.

## The GM Endowment and Opportunities

The AM Inventory, assembled in 1983, contains seven records of large facilities with 750 or more employees in Genesee County. These facilities reported the presence of, on the average, almost 100 types of machine tools totaling almost 6,000 pieces of metalworking equipment. The seven plants can be listed by the following self-reported primary products (4-digit SIC) as shown in table 5:

Table 5  
AM Inventory of GM Machine Tool Endowments

<u>SIC</u>	<u>Industry</u>	<u>Employment</u>	<u># of Machine Tools</u>
3429	Hardware	4,050	583
3465	Auto Stampings	4,500	439
3714(1)	Auto Parts	1,000	695
3714(2)	" "	5,000	1,005
3714(3)	" "	1,000	338
3714(4)	" "	750	1,985
3711	Assembly	<u>4,000</u>	<u>844</u>
Total		20,300	5,889

Table 5 shows that the AM Inventory contains completed records for four large auto parts manufacturing establishments with employment levels ranging from 750 to 5,000. These parts producing facilities contained, in the aggregate, 4,023 machine tools of the various types. The ratio of machine tools to employment in the seven GM records is about 1 to 3.45. The typical small to medium metalworking shop demonstrates a ratio of about 2 to 1. If the Flint GM facilities, as a group, are running at the same level below capacity as the corporation as a whole, 25%, then about 25% of the 5,889 machine tools listed above are not and will not be used. If these 1,472 machine tools were utilized in machine shop fashion, or in the performance of job shop, non-automotive contracts, they would support about 736 manufacturing jobs in Flint. Yet there are strong reasons to believe that the machine tool sum in table 5 only represents about half of GM's machine tool endowment in the Flint area. If so, a maximum total of 1,500 potential jobs could be created if GM management reapplies unused GM equipment capacity to non-

**automotive metal-working markets.** To be sure this would not be an easy task or set of tasks for the management of any manufacturing firm. The equipment or the necessary skilled labor is not conveniently idled in one or several locations. It must be reorganized for the purposes of an entirely new style of production. The technical barriers to this process are undoubtedly complex and varied and will not be fully discussed here. The reasons for considering this undertaking will be focussed upon first. To start, this report will concentrate, by way of example, on new market opportunities for GM auto parts facilities (SIC 3714 ) listed in Table 5.

### ***Linked supplier markets for direct entry***

It may come as a surprise to some to learn that a number of other industries purchase products from the auto parts industry aside from original equipment manufacturers and purveyors of aftermarket auto parts. These industries were identified through the use of the National Input-Output matrix. They included industries that produced nineteen of the fast-growing products listed in table 3. The nineteen products are re-listed, with their estimated 1986 purchase levels of automotive parts in table 6. The largest direct entry supplier market is auto parts supplied to producers of Search & Detection, navigation & guidance systems (SIC 36625), at \$16.23 million of automotive parts in 1986. The fast growing linked supplier markets identified for SIC 3714 only sum to \$38.44 million in 1986. Despite their strong growth performance, then, the direct entry markets are small in size and present little volume opportunity for the large plants considered in this analysis.

### ***Linked supplier markets for crosswalk entry***

Crosswalk opportunities require the facility to produce product for non-traditional markets. Any recommendations regarding such opportunities must be based on a careful analysis of technical capacity. Table 7 is an exhibit of the level of detail provided by the AM Inventory for the four large auto parts plants. The four plant records are merged in the interests of confidentiality. All machine tool types with more than 20 machines are listed in the table in terms of their total percent contribution to the plant's overall machine tool endowment. For example, the table shows that 13.75% (roughly 553 machines) of all the machine tools in the four plants fell into the machine tool category "NON-NC GRINDING MACHINES," the most

**Table 6**

Potential Customer Markets for Supplier 3714

Motor vehicle parts and accessories

Tier 1 Analysis

Destination SIC	Market Value
Search & detection, navigation & guidance systems (36625)	\$16.23
Communications systems and equipment (ex. broadcasting) (36621)	6.01
Golf carts and industrial personnel carriers (37993)	5.70
Construction machinery, n.s.k. (35310)	2.25
Electronic systems and equipment, n.e.c. (36627)	2.08
Other sheet metal work (34446)	1.89
Electronic computing equipment (35731)	0.80
Peripheral equipment for computers (35732)	0.69
Inboard-outdrive boats, except houseboats (37326)	0.51
Inboard motorboats (37325)	0.44
Other electrical equipment for internal combustion engine (36945)	0.44
Parts and attachments for computers (35733)	0.41
Military aircraft (37211)	0.18
Surgical appliances and supplies (38421)	0.17
Aircraft parts & accessories, n.e.c. (37281)	0.17
Ignition harness and cable sets (36941)	0.13
Civilian aircraft (37212)	0.12
Metal doors and frames (ex. storm doors) (34421)	0.11
Aluminum cans (34112)	0.11
<b>Total Market Value</b>	<b>\$38.44</b>

Industry size: 57272.0

numerous type within this category being "Tool And Cutter" (5.44% or roughly 219 grinders). About 27% of the machine tools contained in these plants fell into machine types that individually constituted less than .5% of the total machine tool endowment.

Table 7 lists every machine tool type that constitutes .5% or above of the total 1983 machine tool endowment of the four large (GM) auto parts facilities located in Flint. This list was systematically matched against the average machine tool contributions of over 184 separate samples of 4-digit metalworking industries contained in the inventory. Differencing scores were computed, that measure the "relative" closeness of the combined four plants to these industries. A strong assumption underlying this approach to "closeness" is that small differences in machine tool use should also imply correspondingly small differences in labor force skills, a management experience and scale.

Table 8 contains the results of the crosswalks analysis for the large SIC 3714 establishments. Three types of information are presented for each of the represented industries in table 7. The "Score" column contains the differencing values from the comparison analysis. Median employment levels for the comparison industry samples are given in the second column. Finally, the third column contains the 1986 dollar sum values of the crosswalks markets, first and second tier, connected to these comparison industries. It should be emphasized that these markets refer to the sum of first and second tier supplier markets connected to the fast-growing product markets listed in table 3. There were 30,000 such possible markets.

Certain automotive industries were included in the differencing analysis for purposes of comparison in terms of "closeness," and also because they also supply non-automotive industries with automotive parts products. The smaller the "Score" for a particular industry in table 8, the closer the Flint SIC 3714 facilities were to this industry in terms of the structure of their machine tool endowment. For example, the closest industry, not surprisingly, was auto parts manufacturing industry itself with a Score of 38.46.<sup>17</sup> This comparison was based on the records of the four Flint plants versus 92 other auto parts plant records contained in the AM Inventory. The combined machine tool

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17. The \$47.02 million in fast growing supplier markets listed in table 7 include the sum of \$38.44 first tier supplier markets listed in table 6, and an additional \$8.6 million in fast-growing second tier supplier markets for auto parts.

**Table 7**

**List of tool percent contributions for  
Motor vehicle parts and accessories**

Machine Tool Description	Percent Contribution
<b>NON-NC TURNING MACHINES</b>	<b>5.52</b>
Eng & Trlm (Not Tracer) Over 8-In To 16-In Swing (10202)	2.00
Tracer Lathes (All Sizes) (10204)	0.51
Turret Lathes (All Non-Nc) (10205)	0.50
Auto Chuckers, Vert & Horiz: Multi-Spndl (10207)	0.57
All Other Non-Nc Turning (10211)	1.27
<b>NON-NC BORING MACHINES</b>	<b>1.72</b>
Precision, Horiz & Vert (10403)	1.27
<b>NON-NC DRILLING MACHINES</b>	<b>6.32</b>
Vertical Upright (Hand Or Power Feed) (10601)	3.75
Radial (10602)	1.76
<b>NON-NC MILLING MACHINES</b>	<b>4.90</b>
Vert, Ram Type With Swivel Head (10901)	0.85
Gen Purpose, Knee Or Bed: Vertical (10902)	1.08
Gen Purpose, Knee Or Bed: Horizontal (10903)	0.93
Profiling And Duplicating (10905)	0.68
All Other Non-Nc Milling (10907)	0.82
<b>NON-NC GRINDING MACHINES</b>	<b>13.75</b>
External: Plain Centertype (11201)	0.79
External: Universal Centertype (11202)	0.72
Internal (Chucking, Crtless, Shoe Type) (11205)	0.66
Surface: Reciprocating, Vert & Horiz, Power (11208)	1.90
Tool And Cutter (11209)	5.44
Bench, Floor, And Snag (11210)	1.16
Disk Grinders, Single & Double Spndl (11211)	0.77
All Other Non-Nc Grinders (Incl Jig) (11213)	2.08
<b>HONING, LAPPING, POLISHING MACHINES</b>	<b>2.26</b>
Polishing Stnds (Incl Abrsv Bit-Not Grd) (11305)	1.27
All Other (Incl Speed Lathes) (11306)	0.99
<b>STATION-TYPE MACHINES</b>	<b>2.07</b>
Multi-Station: Rotary Transfer (11402)	1.21
Multi-Station: In-Line Transfer (11403)	0.86
<b>THREADING MACHINES (NOT MILL, GRIND, ROLL)</b>	<b>0.76</b>
Threading Machines (Not Mill, Grind, Roll) (11701)	0.76
<b>CUTOFF &amp; SAWING MACHINES</b>	<b>3.98</b>
Abrasive Wheel (11803)	0.76
Bandsaw, Contour Sawing & Filing (11804)	3.12



ELECTRICAL-MACHINING UNITS	0.74
All Other (Incl Elg & Ecg) (12104)	0.74
NON-NC PUNCHING & SHEARING MACHINES	1.70
Plate & Sheet Shears: Mechanical (20202)	1.05
Other Power Operated Non-Nc Punch & Shear (20205)	0.54
NON-NC BENDING & FORMING MACHINES (POWER)	1.85
Press Brakes: Mechanical (20401)	0.57
Bending Rolls, Angles, Vars, Shapes, Pipe (20404)	0.51
MECHANICAL PRESSES-POWER (NOT FORGE)	4.29
Two Point: 300 Tons Or Under (20504)	4.29
HYDRAULIC PRESSES (NOT FORGE)	2.90
C-Frame Or Gap: 15 Tones Or Under (20602)	2.90
COIL-PROCESSING SYSTEMS	5.85
Coil Processing Systems (20801)	5.85
THREAD-ROLLING MACHINES	0.71
Thread Rolling Machines (21301)	0.71
AUTOMATIC ASSEMBLY MACHINES (ALL TYPES)	0.77
Non-Prog Aut Asmbly In-Line Synchronous (30104)	0.69
ELECTRIC ARC-WELDING EQUIPMENT	5.65
Manual Weld Equip (No. Of Pwr Supplies) (30301)	4.00
Automatic Machines (30303)	1.65
ELECTRIC RESISTANCE-WELDING EQUIPMENT	1.55
Other (Projection, Butt, & Flash) (30402)	1.55
PLASTIC-MOLDING MACHINES	1.11
Injection (40101)	0.81
INSPECTION & MEASURING MACHINES	2.27
Optical Comparators (40202)	0.80
Balancing Machines (40205)	1.41
HEAT-TREATING EQUIPMENT	1.36
Furnaces: Continuous (40302)	0.70
Other Heat-Treat Units: Induction & Resistance (40303)	0.66
CLEANING & FINISHING EQUIPMENT	5.80
Barrel Finishing (Tumbling) Machines (40501)	0.72
Shot, Abrasive & Other Blast Units (40503)	0.92
Parts Wash Machines (40504)	3.19
Other	27.26

**Table 8**

**Crosswalk for  
Motor vehicle parts and accessories**

SIC Code: 3714

SIC Description	Score	Median Employ	Market Size
Motor vehicle parts and accessories (3714)	38.46	160.00	47.02
Motor vehicles car bodies (3711)	41.45	2500.00	106.10
Automotive stampings (3465)	42.53	100.00	1220.65
Motors & generators (3621)	46.95	250.00	1419.42
Storage batteries (3691)	47.00	180.00	13.72
ENGINE ELECTRICAL EQUIPMENT (3694)	47.16	200.00	384.39
Hand and edge tools, except machine tools (3423)	49.10	70.00	99.97
MISCELLANEOUS FABRICATED WIRE PRODUCTS (3496)	49.20	55.00	316.47
Internal combustion engines, n.e.c. (3519)	49.53	300.00	317.70
Power driven hand tools (3546)	49.65	140.00	16.36
ELECTRIC HOUSEWARES AND FANS (3634)	50.02	125.00	49.68
Carburetors, pistons, piston rings, and valves (3592)	50.73	87.00	245.79
Hardware, n.e.c. (3429)	50.85	60.00	413.64
Household cooking equipment (3631)	51.13	480.00	2.75
Fabricated metal products (3499)	51.15	50.00	730.95

Difference score from 3714 to National 3714 = 38.46

endowment for the four Flint plants also closely matched that for four additional automotive industry classifications. The closest, potential, non-automotive, crosswalk industry, then, was ENGINE ELECTRICAL EQUIPMENT (SIC 3694) with a score of 47.16 (23%

greater than automotive parts). A total of \$384.39 million in fast growing supplier markets were identified for SIC 3694 in 1986. This total includes only first and second tier supplier markets linked to the fast growing markets listed in table 3, but does not include the \$797 million in "final-use" products listed for SIC 36941 as an entry in table 3.

A natural question arises as to how "close" Flint auto parts facilities really are to typical facilities in SIC 3694. The AM Inventory contained 32 records of facilities producing engine electrical equipment as primary goods. Median employment for this sample was 200, far below the average size of the four Flint auto parts facilities. Table 9 shows the typical machine tool endowment structure of a SIC 3694 facility in the AM Inventory. Along with the average percent contributions of machine tools significant in the SIC 3694 group, table 8 provides a corresponding figure that measures the percentage of facilities that had at least one unit of the specific machine tool on the premises. A very high percentage of facilities reporting the presence of a specific machine tool is strong evidence of the requirement for this equipment in the production of commodities in the specific industry. For example, 100% of the SIC 3694 firms reported the presence of cutoff & sawing machines (over 78% reporting at least one bandsaw). High percentages were also reported for turning, drilling, milling, and power press equipment, as well as cleaning and finishing equipment.. All of these machine tool categories and the majority of machine tool types were reported as present in table 7 for the Flint auto parts facilities. The percent contribution figures in the two tables match fairly closely as well, especially in the category of grinding machines. It would certainly seem that the Flint facilities would not have a significant problem in collecting the equipment necessary for the production of SIC 3694 products.

Fourteen crosswalk industries are listed in table 8 for the Flint SIC 3714 facilities. The 14 crosswalk industries are the "closest: of the 184 potential industries considered in analysis, and are ranked in descending order by difference scores. These industries are estimated

to have supplied \$5.33 billion worth of product to the fast growing end-use product producers listed in table 3. Three of the crosswalk industries also produced fast growing final-use products themselves (SICs 3694, 3496, and 3634). An example of potential supplier activity is shown in table 10. SIC 3423, the Hand and edge tools industry, is estimated to have supplied almost \$100 million worth of intermediate goods, at the first tier of supply in 1986, to various producers of products listed in table 3. The largest customers industries are those involved in the production of aircraft engines and parts, and telephone switchboard equipment. If the Flint GM auto parts plants are indeed close in technical capacity to facilities in SIC 3423, then they presumably could also participate in the identified supplier markets listed in table 10.

### *The Opportunity Set*

The three remaining GM facilities are also included in the analysis, and a selection of results for these plants are shown below. The machine tool endowments for these plants are not shown in order to maintain confidentiality. The results are restricted here to tables 11 through 19 which contain the first tier market opportunities, selected crosswalks industries, and first tier opportunities from one of the crosswalks industries for each of the GM plants (SICs 3429, 3465 and 3711).

A striking pattern in the differencing results for the three remaining GM records is that they appear to match more closely in their machine tool structure several other crosswalk industries than their own industries. For example, the difference score for the SIC 3429 facility to its own national sample was 50.20. But the same Flint plant demonstrates a score of 48.02 when matched with the national sample of automotive stampings (SIC 3465) facilities. The vehicle final assembly plant (SIC 3711) is more closely matched to no less than ten crosswalk industries than other motor vehicle assembly plants in the AM Inventory. The striking diversity of the Flint facilities might be explained by their age. Older automotive plants were first operated in a period when motor vehicle production was more integrated within the plant and the area in which it was located. It certainly would be ironic if the so-called obsolescence of the Flint facilities proved to be an advantage in terms of their inherent flexibility and capacity to enter non-automotive manufacturing.

**Table 9**  
**Machine Tool Endowments**

List of tool percent contributions for (3694)

Engine electrical equipment

Machine Tool Description	Percent of Firms	Percent Contribution
<b>NON-NC TURNING MACHINES</b>	<b>84.38%</b>	<b>12.10</b>
Eng & Tlrm (Not Tracer) Up To & Incl 8-In Swing (10201)	40.63	1.49
Eng & Tlrm (Not Tracer) Over 8-In To 16-In Swing (10202)	65.63	3.88
Turret Lathes (All Non-Nc) (10205)	50.00	1.85
Auto Chuckers, Vert & Horiz: Sgl Spndl (10206)	15.63	0.73
Auto Chuckers, Vert & Horiz: Multi-Spndl (10207)	18.75	0.65
Automatic Bar (Screw) Mach, Sgl Spndl (10208)	21.88	1.38
Automatic Bar Machines, Multi-Spndl (10209)	25.00	1.40
All Other Non-Nc Turning (10211)	18.75	0.51
<b>NON-NC DRILLING MACHINES</b>	<b>96.88%</b>	<b>12.90</b>
Vertical Upright (Hand Or Power Feed) (10601)	84.38	10.11
Radial (10602)	43.75	0.64
Multi-Spndl Cluster (Adj & Fxd Ctr) (10603)	40.63	1.10
All Other Non-Nc (Exc Way Type) (10605)	18.75	1.02
<b>NON-NC MILLING MACHINES</b>	<b>87.50%</b>	<b>5.57</b>
Vert, Ram Type With Swivel Head (10901)	56.25	1.81
Gen Purpose, Knee Or Bed: Vertical (10902)	46.88	1.69
Gen Purpose, Knee Or Bed: Horizontal (10903)	50.00	1.08
All Other Non-Nc Milling (10907)	18.75	0.56
<b>NON-NC GRINDING MACHINES</b>	<b>93.75%</b>	<b>12.81</b>
External: Universal Centertype (11202)	28.13	0.84
External: Centerless (Incl Shoe Type) (11203)	31.25	1.41
Surface: Reciprocating, Horiz, Hand (11207)	43.75	1.50
Surface: Reciprocating, Vert & Horiz, Power (11208)	43.75	1.37
Tool And Cutter (11209)	53.13	1.40
Bench, Floor, And Snag (11210)	71.88	3.76
Abrasive Bell (Except Finishing) (11212)	43.75	1.44
<b>TAPPING MACHINES</b>	<b>31.25%</b>	<b>0.73</b>
Tapping Machines (11601)	31.25	0.73
<b>CUTOFF &amp; SAWING MACHINES</b>	<b>100.00%</b>	<b>4.96</b>
Hacksaw (11801)	56.25	1.13
Circular Cutoff Saws (11802)	28.13	0.53
Abrasive Wheel (11803)	40.63	0.68
Bandsaw, Contour Sawing & Filing (11804)	78.13	2.10
All Other (Incl Friction) (11805)	3.13	0.52
<b>NON-NC PUNCHING &amp; SHEARING MACHINES</b>	<b>46.88%</b>	<b>1.80</b>
Plate & Sheet Shears: Mechanical (20202)	37.50	0.92
<b>NON-NC BENDING &amp; FORMING MACHINES (POWER)</b>	<b>46.88%</b>	<b>2.57</b>
Press Brakes: Mechanical (20401)	25.00	0.78
Rotary Bending & Forming Machines (20405)	12.50	0.71

MECHANICAL PRESSES-POWER (NOT FORGE) Open Back (Obi) & Gap: 51 Tons & Over (20502) Two Point: 300 Tons Or Under (20504) All Other Mechanical Presses (20506)	71.88% 28.13 21.88 9.38	7.70 1.42 0.68 0.59
HYDRAULIC PRESSES (NOT FORGE) C-Frame Or Gap: 15 Tones Or Under (20602)	43.75% 28.13	2.08 1.14
COIL-PROCESSING SYSTEMS Coil Processing Systems (20801)	21.88% 21.88	0.86 0.86
DIECASTING MACHINES (HOT & COLD CHBR) Die Casting Machines (Hot And Cold Chbr) (21101)	15.63% 15.63	0.88 0.88
RIVETING MACHINES (NOT PORTABLE) Riveting Machines (Not Portable) (30201)	34.38% 34.38	4.20 4.20
ELECTRIC RESISTANCE-WELDING EQUIPMENT Spot And Seam (30401)	46.88% 43.75	1.78 1.39
PLASTIC-MOLDING MACHINES Injection (40101) Compression (40102) Other (Incl Vacuum Forming, Rotational) (40103)	25.00% 25.00 15.63 6.25	4.15 3.02 0.52 0.62
INSPECTION & MEASURING MACHINES Optical Comparators (40202) Balancing Machines (40205)	50.00% 40.63 25.00	1.76 0.57 0.94
BAKING & DRYING OVENS Baking & Drying Ovens (40401)	53.13% 53.13	2.58 2.58
CLEANING & FINISHING EQUIPMENT Vibratory Finishing Machines (40502) Shot, Abrasive & Other Blast Units (40503) Parts Wash Machines (40504) Degreasers (40505) Painting Systems (40507)	75.00% 28.13 43.75 37.50 31.25 21.88	3.95 0.52 0.71 0.80 0.54 0.65

Sample size: 32

**Table 10**

Potential Customer Markets for Supplier 3423

Hand and edge tools, except machine tools

Tier 1 Analysis

Destination SIC	Market Value
Aircraft engine parts & accessories (37244)	\$31.52
Telephone switchboard equipment (36611)	14.48
Military aircraft (37211)	5.85
Aircraft parts & accessories, n.e.c. (37281)	5.85
Surgical appliances and supplies (38421)	5.05
Civilian aircraft (37212)	4.07
Other printing trade machinery & equipment (35555)	3.62
Search & detection, navigation & guidance systems (36625)	2.40
Commercial cooking and foodwarming equipment (35891)	1.65
Aeronautical, nautical & navigational instruments (38111)	1.44
Communications systems and equipment (ex. broadcasting) (36621)	0.89
Unitary air conditioners (35852)	0.86
R & D on aircraft parts (37283)	0.85
Electronic computing equipment (35731)	0.80
Peripheral equipment for computers (35732)	0.69
Other metal office furniture (25224)	0.65
Other sheet metal work (34446)	0.54
Metal doors and frames (ex. storm doors) (34421)	0.53
Commercial and industrial vacuum cleaners (35893)	0.50
Inboard-outdrive boats, except houseboats (37326)	0.49
Testing equipment for electrical circuits & motors (38252)	0.48
Office storage units, files, and tables (ex. wood) (25223)	0.47
Commercial refrigeration equipment (35853)	0.43
Inboard motorboats (37325)	0.42
Parts and attachments for computers (35733)	0.41
Metal office seating, incl. upholstered (ex. wood) (25221)	0.40
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	0.39
Aluminum cans (34112)	0.38
Metal window sashes and frames (ex. storm sashes) (34422)	0.35
Electric razors and dry shavers (36342)	0.31
Electronic systems and equipment, n.e.c. (36627)	0.31
Fixtures for stores, banks, etc. (ex. wood) (25424)	0.28
Surgical appliances and supplies, n.s.k. (38420)	0.28
Venetian Blinds (25912)	0.23

Other electrical equipment for internal combustion engine (36945)	0.23
Electronic hearing aids (38424)	0.19
Household vacuum cleaners, parts and attachments (36350)	0.17
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	0.16
Binding machinery and equipment (35554)	0.15
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	0.15
Golf equipment (39492)	0.12
Aircraft propellers (37285)	0.10
<b>Total Market Value</b>	<b>\$89.14</b>

Industry size: 2915.0



## Table 11

### Potential Customer Markets for Supplier 3429

Hardware, n.e.c.

Tier 1 Analysis

Destination SIC	Market Value
Military aircraft (37211)	\$65.59
Other metal office furniture (25224)	60.08
Civilian aircraft (37212)	45.64
Office storage units, files, and tables (ex. wood) (25223)	43.03
Aircraft parts & accessories, n.e.c. (37281)	41.43
Metal office seating, incl. upholstered (ex. wood) (25221)	37.12
Fixtures for stores, banks, etc. (ex. wood) (25424)	11.38
Telephone switchboard equipment (36611)	10.83
Electric razors and dry shavers (36342)	9.73
Aircraft engine parts & accessories (37244)	7.90
Unitary air conditioners (35852)	7.60
Inboard-outdrive boats, except houseboats (37326)	7.18
Inboard motorboats (37325)	6.22
R & D on aircraft parts (37283)	6.02
Household water heaters, except electric (36392)	5.05
Commercial refrigeration equipment (35853)	3.82
Household water heaters, electric (36391)	3.78
Partitions, except wood (25421)	3.50
Surgical appliances and supplies (38421)	3.46
Partitions, shelving, lockers, and fixtures (ex. (25420)	2.82
Industrial trucks and tractors, n.s.k. (35370)	1.99
Commercial cooking and foodwarming equipment (35891)	1.51
Metal doors and frames (ex. storm doors) (34421)	1.47
Parts for small appliances (36344)	1.17
Parts for automatic merchandise machines (35812)	0.98
Metal window sashes and frames (ex. storm sashes) (34422)	0.96
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	0.80
Aircraft propellers (37285)	0.74
Radio and TV receiving sets, n.s.k. (36510)	0.67
Commercial and industrial vacuum cleaners (35893)	0.46

Surgical appliances and supplies, n.s.k. (38420)	0.19
Electronic hearing aids (38424)	0.13
<b>Total Market Value</b>	<b>\$393.25</b>

Industry size: 7512.4

Table 12

Crosswalk for  
3429: Hardware, n.e.c.

SIC Code: 3429

SIC Description	Score	Median Employ	Market Size
Automotive stampings (3465)	48.02	100.00	1220.65
Hardware, n.e.c. (3429)	50.20	60.00	413.64
ENGINE ELECTRICAL EQUIPMENT (3694)	50.44	200.00	384.39
Motor vehicle parts and accessories (3714)	50.88	160.00	47.02
Cutlery (3421)	52.04	75.00	2.92
Hand and edge tools, except machine tools (3423)	52.98	70.00	99.97
Motor vehicles car bodies (3711)	53.37	2500.00	106.10
Household refrigerators and freezers (3632)	54.01	530.00	0.68
Jewelry, precious metal (3911)	54.59	35.00	1.75
Hand saws and saw blades (3425)	54.68	65.00	21.72
Motors & generators (3621)	54.96	250.00	1419.42
Household cooking equipment (3631)	55.57	480.00	2.75
ELECTRIC HOUSEWARES AND FANS (3634)	55.58	125.00	49.68
Carburetors, pistons, piston rings, and valves (3592)	55.60	87.00	245.79
Storage batteries (3691)	55.78	180.00	13.72

Difference score from 3429 to National 3429 = 50.20

**Table 13**

Potential Customer Markets for Supplier 3694

Engine electrical equipment

Tier 1 Analysis

Destination SIC	Market Value
Other electrical equipment for internal combustion engine (36945)	\$173.07
Military aircraft (37211)	56.55
Ignition harness and cable sets (36941)	50.88
Civilian aircraft (37212)	39.35
Aircraft engine parts & accessories (37244)	17.63
Aircraft parts & accessories, n.e.c. (37281)	8.02
Inboard-outdrive boats, except houseboats (37326)	2.31
Inboard motorboats (37325)	2.00
R & D on aircraft parts (37283)	1.17
Electronic computing equipment (35731)	0.80
Peripheral equipment for computers (35732)	0.69
Parts and attachments for computers (35733)	0.41
Search & detection, navigation & guidance systems (36625)	0.30
Aeronautical, nautical & navigational instruments (38111)	0.24
Aircraft propellers (37285)	0.14
Communications systems and equipment (ex. broadcasting) (36621)	0.11
<b>Total Market Value</b>	<b>\$353.67</b>

Industry size: 5774.0

**Table 14**

## Potential Customer Markets for Supplier 3465

## Automotive stampings

## Tier 1 Analysis

Destination SIC	Market Value
Electronic computing equipment (35731)	\$153.88
Peripheral equipment for computers (35732)	132.79
Parts and attachments for computers (35733)	78.54
Search & detection, navigation & guidance systems (36625)	63.72
Surgical appliances and supplies (38421)	52.05
Testing equipment for electrical circuits & motors (38252)	51.58
Unitary air conditioners (35852)	38.95
Military aircraft (37211)	37.23
Aircraft parts & accessories, n.e.c. (37281)	34.92
Civilian aircraft (37212)	25.90
Communications systems and equipment (ex. broadcasting) (36621)	23.60
Commercial refrigeration equipment (35853)	19.58
Electric razors and dry shavers (36342)	18.83
Aircraft engine parts & accessories (37244)	18.23
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	17.32
Telephone switchboard equipment (36611)	15.80
Household vacuum cleaners, parts and attachments (36350)	11.82
Other metal office furniture (25224)	11.50
Commercial cooking and foodwarming equipment (35891)	10.93
Electronic computing equipment, n.s.k. (35730)	10.11
Other sheet metal work (34446)	9.18
Aeronautical, nautical & navigational instruments (38111)	9.00
Metal doors and frames (ex. storm doors) (34421)	8.96
Office storage units, files, and tables (ex. wood) (25223)	8.23
Electronic systems and equipment, n.e.c. (38627)	8.15
Mailing, letter handling, addressing machines (35795)	7.99
Metal office seating, incl. upholstered (ex. wood) (25221)	7.10
Other electrical equipment for internal combustion engine (36945)	6.36
Metal window sashes and frames (ex. storm sashes) (34422)	5.87
Fixtures for stores, banks, etc. (ex. wood) (25424)	5.54
R & D on aircraft parts (37283)	5.07
Household water heaters, except electric (36392)	3.86
Physical properties testing and inspection equipment (38292)	3.65
Commercial and industrial vacuum cleaners (35893)	3.31

Household water heaters, electric (36391)	2.89
Surgical appliances and supplies, n.s.k. (38420)	2.85
Parts for automatic merchandise machines (35812)	2.67
Aircraft engine instruments, except flight (38291)	2.58
Radio and TV receiving sets, n.s.k. (36510)	2.35
Parts for small appliances (36344)	2.27
Venetian Blinds (25912)	2.26
Electrical equipment, n.e.c, n.s.k. (36990)	2.07
Electronic hearing aids (38424)	1.93
Prefabricated metal buildings, n.s.k. (34480)	1.89
Ignition harness and cable sets (36941)	1.87
Partions, except wood (25421)	1.71
Aluminum cans (34112)	1.42
Partitions, shelving, lockers, and fixtures (ex. (25420)	1.37
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	1.03
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	0.97
Aircraft propellers (37285)	0.62
Golf carts and industrial personel carriers (37993)	0.48
Inboard-outdrive boats, except houseboats (37326)	0.47
Inboard motorboats (37325)	0.41
Industrial trucks and tractors, n.s.k. (35370)	0.38
Construction machinery, n.s.k. (35310)	0.28
Total Market Value	\$954.32

Industry size: 15697.7

**Table 15**  
**Crosswalk for**  
**3465: Automotive stampings**

SIC Code: 3465

SIC Description	Score	Median Employ	Market Size
Motor vehicles car bodies (3711)	48.64	2500.00	108.10
Automotive stampings (3465)	51.57	100.00	1220.65
HOUSEHOLD APPLIANCES, N.E.C. (3639)	58.77	350.00	0.00
Lawn and garden equipment (3524)	58.83	125.00	0.00
Fabricated metal products (3499)	59.08	50.00	730.95
Steel pipe and tubes (3317)	60.11	121.00	584.21
REFRIGERATION AND HEATING EQUIPMENT (3585)	60.86	110.00	334.63
Heating equipment, except electric (3433)	60.88	65.00	22.07
SHEET METAL WORK (3444)	60.90	45.00	939.27
Architectural and ornamental metal work (3446)	61.00	50.00	0.00
Motor vehicle parts and accessories (3714)	61.08	160.00	47.02
Blowers and fans (3564)	61.40	100.00	82.67
Household refrigerators and freezers (3632)	61.54	530.00	0.68
SERVICE INDUSTRY MACHINES, N.E.C. (3589)	61.97	80.00	8.50
Form machinery and equipment (3523)	62.11	75.00	0.00

Difference score from 3465 to National 3465 = 51.57

**Table 16**

Potential Customer Markets for Supplier 3317

Steel pipe and tubes

Tier 1 Analysis

Destination SIC	Market Value
Aluminum cans (34112)	\$102.74
Other sheet metal work (34446)	57.37
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	50.12
Other metal office furniture (25224)	17.79
Fixtures for stores, banks, etc. (ex. wood) (25424)	14.21
Aircraft parts & accessories, n.e.c. (37281)	13.20
Office storage units, files, and tables (ex. wood) (25223)	12.75
Metal doors and frames (ex. storm doors) (34421)	11.40
Metal office seating, incl. upholstered (ex. wood) (25221)	10.99
Unitary air conditioners (35852)	10.69
Aircraft engine parts & accessories (37244)	8.86
Other electrical equipment for internal combustion engine (36945)	8.35
Metal window sashes and frames (ex. storm sashes) (34422)	7.46
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	7.21
Search & detection, navigation & guidance systems (36625)	6.91
Other printing trade machinery & equipment (35555)	6.41
Prefabricated metal buildings, n.s.k. (34480)	5.47
Commercial refrigeration equipment (35853)	5.37
Surgical appliances and supplies (38421)	5.28
Commercial cooking and foodwarming equipment (35891)	4.98
Household water heaters, except electric (36392)	4.96
Electric razors and dry shavers (36342)	4.95
Partions, except wood (25421)	4.38
Military aircraft (37211)	4.08
Household water heaters, electric (36391)	3.71
Partitions, shelving, lockers, and fixtures (ex. (25420)	3.53
Venetian Blinds (25912)	3.48
Testing equipment for electrical circuits & motors (38252)	3.33
Metal cans, n.s.k. (34110)	3.28
Household laundry equipment, n.e.c. (36333)	3.23
Electronic computing equipment (35731)	3.19
Civilian aircraft (37212)	2.84
Peripheral equipment for computers (35732)	2.76
Golf carts and industrial personel carriers (37993)	2.70



Communications systems and equipment (ex. broadcasting) (36621)	2.56
Telephone switchboard equipment (36611)	2.49
Ignition harness and cable sets (36941)	2.45
Household vacuum cleaners, parts and attachments (36350)	2.28
Construction machinery, n.s.k. (35310)	2.15
Golf equipment (39492)	2.04
Aeronautical, nautical & navigational instruments (38111)	2.03
R & D on aircraft parts (37283)	1.92
Parts and attachments for computers (35733)	1.83
Commercial and industrial vacuum cleaners (35893)	1.51
Playground, gymnasium, and exercise equipment (39494)	1.36
Industrial trucks and tractors, n.s.k. (35370)	1.35
Parts for automatic merchandise machines (35812)	1.12
Physical properties testing and inspection equipment (38292)	0.94
Electronic systems and equipment, n.e.c. (36627)	0.88
Mailing, letter handling, addressing machines (35795)	0.86
Aircraft engine instruments, except flight (38291)	0.66
Parts for small appliances (36344)	0.60
Inboard-outdrive boats, except houseboats (37326)	0.43
Inboard motorboats (37325)	0.37
Surgical appliances and supplies, n.s.k. (38420)	0.29
Binding machinery and equipment (35554)	0.27
Electrical equipment, n.e.c., n.s.k. (36990)	0.25
Aircraft propellers (37285)	0.24
Electronic computing equipment, n.s.k. (35730)	0.21
Electronic hearing aids (38424)	0.20
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	0.13
<b>Total Market Value</b>	<b>\$449.20</b>

Industry size: 3327.8

**Table 17**

## Potential Customer Markets for Supplier 3711

## Motor vehicles car bodies

## Tier 1 Analysis

Destination SIC	Market Value
Search & detection, navigation & guidance systems (36625)	\$35.16
Communications systems and equipment (ex. broadcasting) (36621)	13.03
Golf carts and industrial personnel carriers (37993)	12.33
Construction machinery, n.s.k. (35310)	4.87
Electronic systems and equipment, n.e.c. (36627)	4.50
Other sheet metal work (34446)	4.12
Electronic computing equipment (35731)	2.00
Peripheral equipment for computers (35732)	1.72
Inboard-outdrive boats, except houseboats (37326)	1.09
Parts and attachments for computers (35733)	1.02
Other electrical equipment for internal combustion engine (36945)	0.98
Inboard motorboats (37325)	0.94
Aircraft parts & accessories, n.e.c. (37281)	0.50
Military aircraft (37211)	0.35
Surgical appliances and supplies (38421)	0.34
Ignition harness and cable sets (36941)	0.29
Aircraft engine parts & accessories (37244)	0.26
Metal doors and frames (ex. storm doors) (34421)	0.25
Civilian aircraft (37212)	0.25
Other printing trade machinery & equipment (35555)	0.19
Aluminum cans (34112)	0.16
Metal window sashes and frames (ex. storm sashes) (34422)	0.16
Aeronautical, nautical & navigational instruments (38111)	0.15
Electronic computing equipment, n.s.k. (35730)	0.13
<b>Total Market Value</b>	<b>\$84.79</b>

Industry size: 123951.6

**Table 18**

**Crosswalk for  
3711: Motor vehicle car bodies**

SIC Code: 3711

SIC Description	Score	Median Employ	Market Size
Motor vehicle parts and accessories (3714)	46.56	160.00	47.02
Internal combustion engines, n.e.c. (3519)	49.45	300.00	317.70
Power driven hand tools (3546)	51.16	140.00	16.36
Carburetors, pistons, piston rings, and valves (3592)	51.73	87.00	245.79
Machine tool accessories (3545)	53.44	40.00	385.57
Motors & generators (3621)	53.68	250.00	1419.42
Machine tools, metal cutting types (3541)	54.66	55.00	124.02
ENGINE ELECTRICAL EQUIPMENT (3694)	55.03	200.00	384.39
Power transmission equipment, n.e.c. (3568)	55.09	60.00	117.67
Ball & roller bearings (3562)	55.16	125.00	488.43
Motor vehicles car bodies (3711)	55.46	2500.00	106.10
Cutlery (3421)	55.54	75.00	2.92
Air and gas compressors (3563)	55.54	120.00	110.40
AIRCRAFT ENGINES AND ENGINE PARTS (3724)	55.99	132.00	2693.09
Hand and edge tools, except machine tools (3423)	56.85	70.00	99.97

Difference score from 3711 to National 3711 = 55.46

**Table 19**

## Potential Customer Markets for Supplier 3621

## Motors &amp; generators

## Tier 1 Analysis

Destination SIC	Market Value
Unitary air conditioners (35852)	\$226.42
Electronic computing equipment (35731)	127.14
Commercial refrigeration equipment (35853)	113.80
Peripheral equipment for computers (35732)	109.71
Search & detection, navigation & guidance systems (36625)	98.58
Parts and attachments for computers (35733)	64.89
Other printing trade machinery & equipment (35555)	61.20
Electric razors and dry shavers (36342)	59.94
Household vacuum cleaners, parts and attachments (36350)	54.69
Communications systems and equipment (ex. broadcasting) (36621)	36.52
Household laundry equipment, n.e.c. (36333)	35.15
Commercial cooking and foodwarming equipment (35891)	32.89
Aircraft parts & accessories, n.e.c. (37281)	30.41
Household water heaters, except electric (36392)	23.44
Testing equipment for electrical circuits & motors (38252)	21.17
Household water heaters, electric (36391)	17.54
Aeronautical, nautical & navigational instruments (38111)	16.24
Other sheet metal work (34446)	16.14
Military aircraft (37211)	15.07
Mailing, letter handling, addressing machines (35795)	14.24
Electronic systems and equipment, n.e.c. (36627)	12.61
Civilian aircraft (37212)	10.48
Commercial and industrial vacuum cleaners (35893)	9.95
Electronic computing equipment, n.s.k. (35730)	8.35
Parts for small appliances (36344)	7.21
Aircraft engine parts & accessories (37244)	6.86
Parts for automatic merchandise machines (35812)	6.33
Physical properties testing and inspection equipment (38292)	6.07
Inboard-outdrive boats, except houseboats (37326)	4.59
R & D on aircraft parts (37283)	4.42
Aircraft engine instruments, except flight (38291)	4.28
Inboard motorboats (37325)	3.98
Industrial trucks and tractors, n.s.k. (35370)	3.02
Construction machinery, n.s.k. (35310)	2.98

Binding machinery and equipment (35554)	2.57
Golf equipment (39492)	1.83
Playground, gymnasium, and exercise equipment (39494)	1.22
Radio and TV receiving sets, n.s.k. (36510)	0.92
Aircraft propellers (37285)	0.54
<b>Total Market Value</b>	<b>\$1273.39</b>

Industry size: 7091.0

## V. Crosswalks for Genesee Non-GM Facilities

The AM Inventory contains only 7 records of small, non-GM, manufacturing facilities in Genesee County. Four of these records represent plants and industries included in table 1. The purpose of this report, however, is not to process the entire foundation firm structure of the Genesee manufacturing base through the use of the AM Inventory. Instead, one of the four available records is used to examine the potential of the crosswalks method itself. The selected record comes from Genesee's tool & die industry. A discussion of the dissemination and elaboration of crosswalks for small Genesee manufacturing firms follows this section. For now, each of the remaining Genesee industries is considered in the analysis, and will be compared to parallel results generated for special Michigan subsamples from the overall national AM Inventory.

### **SIC 3544: Special dies, tools, jigs and fixtures**

The *1986 County Business Patterns* publication of the U.S. Census reported the presence of 10 tool & die establishments with employment greater than 9 in Genesee County. The U.S. Department of Commerce estimated that in 1988, shipments of tools, dies, jigs, fixtures amounted to about \$9.2 billion, with an additional amount of related contract machining summing to \$8.4 billion. The 1980s, however, have seen slow growth in shipments from the traditional domestic sector of tool & die firms. The U.S. Department of Commerce forecast negative shipments growth for the 1989-1993 period for this industry, actually projecting an average, annual decline in shipments of 2% over the period. Major problems for the industry are the absolute decline in traditional customer base orders, - particularly from the traditional domestic auto industry - and surging competition from both straight imports and foreign-owned, new competitors here in the United States.

The AM Inventory contains 607 individual records of tool & die facilities, the largest individual industry subsample in the inventory. 99 of these records are provided by facilities located in Michigan. Only one of these Michigan shops, with a total employment of 25, is located in Genesee County. This sole Genesee record will be treated in analysis as an individual crosswalks client, and compared with crosswalks results for Michigan shops in general located in SIC 3544.

The lone Genesee tool & die facility reported the presence of 55 individual machine tools in 1983. Table 20 shows the structure of this firm's machine tool endowment. Grinding machines, by far, account for the bulk of the tools in the facility (19), followed by milling machines (10) and suprisingly, mechanical presses (9). Three large open back presses are listed, a unique feature for a tool & die facility of this size. The Genesee firm is compared with the average national machine tool structure of all 607 SIC 3544 responding facilities in table 21. As can be seen from an examination of the second column of table 21, labeled "Percent of Firms," over 90% of the tool & die firms reported the presence of milling, grinding, and cutoff & sawing machines. Less than 41% of the shops reported the presence of mechanical presses, however, and over 88% did report the use of turning machines. The Genesee shop **did not report the ownership of any turning machines.** This is a significant difference, especially when it is noted that turning machines constitute almost 10% of all machine tools reported by tool & die shops in the AM Inventory. The Genesee shop, then, may not possess the technical capacity to attempt many of the machining contracts available in the tool and die area. The Genesee firm's capacity in press operations, however, may instead allow it to pursue a range of other product opportunities connected to this type of metalworking.

The potential difference in technical capacities between the Genesee shop and the typical tool & die firm is highlighted in tables 22 and 23. Table 22 lists the crosswalks industries selected for the Genesee shop through the matching analysis and table 23 the selected industries for the 99 Michigan facilities in SIC 3544 taken as a group. The differencing procedure with the 184 industry subsamples in the inventory is carried out in the same fashion as was performed for the GM facilities. The Genesee tool & die shop's machine tool structure is differenced with the average percent contributions of each of the 184 other metalworking industries while the weighted average percent contributions of the 99 Michigan tool & die firms is used to generate the results shown in table 23. The Michigan subsample is found to be very close in machine tool structure to the national subsample of 607 tool & die firms with a remarkably low Score of 13.40. The next closest industry is SIC 3541, or firms producing metal cutting machinery. The Genesee tool & die shop, on the other hand, while matching most closely the national sample of tool & die facilities, only achieves a Score of 49.81 when compared to the overall national

**Table 20****List of tool percent contributions for  
3544: Special dies, tools, jigs, and fixtures**

Machine Tool Description	Percent Contribution
NON-NC BORING MACHINES Jig Bore, Horiz & Vert (10404)	3.64
NON-NC DRILLING MACHINES Vertical Upright (Hand Or Power Feed) (10601) Radial (10602)	7.27 3.64
NON-NC MILLING MACHINES Vert, Ram Type With Swivel Head (10901)	18.18
NON-NC GRINDING MACHINES External: Plain Centertype (11201) External: Universal Centertype (11202) Internal (Chucking, Crtlless, Shoe Type) (11205) Surface: Reciprocating, Horiz, Hand (11207) Surface: Reciprocating, Vert & Horiz, Power (11208) Bench, Floor, And Snag (11210) Abrasive Bell (Except Finishing) (11212) All Other Non-Nc Grinders (Incl Jig) (11213)	5.45 1.82 3.64 7.27 3.64 7.27 3.64 1.82
CUTOFF & SAWING MACHINES Hacksaw (11801) Circular Cutoff Saws (11802) Bandsaw, Contour Sawing & Filing (11804)	1.82 7.27 5.45
ELECTRICAL-MACHINING UNITS Ram-Type Electrical Discharge Mach (Edm) (12101)	1.82
MECHANICAL PRESSES-POWER (NOT FORGE) Open Back (Obi) & Gap: Up To 50 Tons (20501) Open Back (Obi) & Gap: 51 Tons & Over (20502) Vertical Straight Side Or Arch: Sgle Pt (20503)	1.82 5.45 1.82
ELECTRIC ARC-WELDING EQUIPMENT Manual Weld Equip (No. Of Pwer Supplies) (30301) Semi-Automatic Machines (30302)	1.82 1.82
Other	3.64



**Table 21**  
**Machine Tool Endowments**

List of tool percent contributions for (3544)

Special dies, tools, jigs and fixtures

Machine Tool Description	Percent of Firms	Percent Contribution
<b>NON-NC TURNING MACHINES</b>	<b>88.47%</b>	<b>9.73</b>
Eng & Tlrm (Not Tracer) Up To & Incl 8-In Swing (10201)	46.62	2.21
Eng & Tlrm (Not Tracer) Over 8-In To 16-In Swing (10202)	66.56	3.64
Eng & Tlrm (Not Tracer) Over 16-In Swing (10203)	40.53	1.69
Tracer Lathes (All Sizes) (10204)	17.13	0.53
Turret Lathes (All Non-Nc) (10205)	19.60	0.81
<b>NON-NC BORING MACHINES</b>	<b>48.11%</b>	<b>2.53</b>
Hor Bore, Drl, Mill (Bar Mach) Table & Planer Type (10401)	17.96	0.70
Jig Bore, Horiz & Vert (10404)	32.95	1.10
<b>NON-NC DRILLING MACHINES</b>	<b>79.41%</b>	<b>7.92</b>
Vertical Upright (Hand Or Power Feed) (10601)	64.25	5.16
Radial (10602)	51.89	1.99
<b>NC MILLING MACHINES</b>	<b>32.45%</b>	<b>1.62</b>
Vert, Ram Type With Swivel Head (10801)	13.84	0.60
Gen Purpose, Knee Or Bed: Vertical (10802)	15.32	0.70
<b>NON-NC MILLING MACHINES</b>	<b>91.10%</b>	<b>18.83</b>
Gen Purpose, Knee Or Bed: Vertical (10902)	49.09	4.05
Gen Purpose, Knee Or Bed: Horizontal (10903)	35.91	1.61
Profiling And Duplicating (10905)	25.37	1.18
Die Sinking, Engraving, Pantograph (10906)	22.73	1.17
All Other Non-Nc Milling (10907)	7.25	0.63
<b>NON-NC GRINDING MACHINES</b>	<b>92.92%</b>	<b>21.86</b>
External: Plain Centertype (11201)	23.56	0.94
External: Universal Centertype (11202)	32.45	1.03
Internal (Chucking, Crtless, Shoe Type) (11205)	19.77	0.67
Surface: Rotary Table, Vert & Horiz (11206)	31.63	1.47
Surface: Reciprocating, Horiz, Hand (11207)	64.09	6.50
Surface: Reciprocating, Vert & Horiz, Power (11208)	45.30	2.36
Tool And Cutter (11209)	48.93	2.17
Bench, Floor, And Snag (11210)	51.89	3.28
Disk Grinders, Single & Double Spindl (11211)	26.19	0.96
Abrasive Bell (Except Finishing) (11212)	41.85	1.33
All Other Non-Nc Grinders (Incl Jig) (11213)	17.63	0.77
<b>TAPPING MACHINES</b>	<b>21.25%</b>	<b>0.61</b>
Tapping Machines (11601)	21.25	0.61
<b>CUTOFF &amp; SAWING MACHINES</b>	<b>92.42%</b>	<b>6.85</b>
Hacksaw (11801)	33.28	0.93
Circular Cutoff Saws (11802)	30.97	1.07
Abrasive Wheel (11803)	30.97	0.81
Bandsaw, Contour Sawing & Filing (11804)	83.20	3.76

<b>ELECTRICAL-MACHINING UNITS</b>	<b>53.05%</b>	<b>3.14</b>	
Ram-Type Electrical Discharge Mach (Edm) (12101)	48.76		2.53
Traveling Wire Edm (12102)	13.18		0.57
<b>ALL OTHER NON-NC METALCUTTING MACHINES</b>	<b>3.29%</b>	<b>0.65</b>	
All Other Non-Nc Metalcutting Machines (12301)	3.29		0.65
<b>MECHANICAL PRESSES-POWER (NOT FORGE)</b>	<b>40.86%</b>	<b>4.73</b>	
Open Back (Obi) & Gap: Up To 50 Tons (20501)	30.97		2.19
Open Back (Obi) & Gap: 51 Tons & Over (20502)	23.56		1.35
<b>ELECTRIC ARC-WELDING EQUIPMENT</b>	<b>51.40%</b>	<b>2.62</b>	
Manual Weld Equip (No. Of Pwer Supplies) (30301)	50.25		2.33
<b>PLASTIC-MOLDING MACHINES</b>	<b>15.65%</b>	<b>2.49</b>	
Injection (40101)	12.85		1.96
<b>INSPECTION &amp; MEASURING MACHINES</b>	<b>52.55%</b>	<b>2.26</b>	
Optical Comparators (40202)	47.61		1.60
<b>BAKING &amp; DRYING OVENS</b>	<b>12.85%</b>	<b>0.65</b>	
Baking & Drying Ovens (40401)	12.85		0.65
<b>CLEANING &amp; FINISHING EQUIPMENT</b>	<b>45.30%</b>	<b>2.08</b>	
Shot, Abrasive & Other Blast Units (40503)	24.22		0.63

Sample size: 607

industry. Michigan shops, as a group, are much closer in structure to the national tool & die industry than is the Genesee respondent.

The two crosswalk industry tables differ to great extent in terms of the ranking of the industries they share and in terms of a number of industries not shared. The latter differences are most important. For example, the fifth closest industry to the Genesee respondent is Industrial patterns (SIC 3565) with a difference Score of 61.03. Industrial patterns is listed as the seventh closest industry to the overall Michigan subsample in table 23, but the Score is only 36.09. Clearly the Industrial patterns industry has a closer machine tool structure to the typical Michigan tool & die firm as compared to the individual Genesee respondent. Some industries like Boat building & repairing (3732), Hand and edge tools (3423), and Household cooking equipment (3631) are ranked in the Genesee's crosswalks list, but do not appear in the Michigan tool & die list. The Michigan tool & die list also includes industries not shown as feasible for the Genesee firm. These results underline the special need for treating individual firms separately in the crosswalks analysis and not relying on general results for national or regional subsamples of the inventory. Every metalworking firm is unique in terms of its machine tool structure and thus capacity for manufacturing.

### *Linked supplier markets for direct entry*

A total of \$989 million in fast growing direct supplier markets are estimated for SIC 3544. The first tier direct supplier markets for the tool & die industry are shown in table 24 and sum to \$755 million. Seven of these markets exceeded \$40 million in shipments in 1986. It is likely that the number of individual contracts contained in these markets are large indeed. A special warning must be issued for the Genesee firm that does not possess turning machinery: the markets listed in table 24 pertain to the tool & die industry as a whole. Since there appear to be significant differences between the Genesee firm and a typical tool & die firm in their machine tool structures, caution should be exercised before serious efforts are undertaken to enter these markets.

An extensive listing of direct second tier markets is shown in table A-24 in Appendix 1. These markets sum to \$341 million in 1986, and are listed in order of size within the first tier customer industries. A typical second tier market listed on the first page table 25 is \$9.23

**Table 22**

**Crosswalk for  
3544: Special dies, tools, jigs, and fixtures**

SIC Code: 3544

SIC Description	Score	Median Employ	Market Size
Special dies, tools, jigs and fixtures (3544)	49.81	30.00	989.44
Machine tool accessories (3545)	58.87	40.00	385.57
Machine tools, metal cutting types (3541)	59.15	55.00	124.02
Special industry machinery, n.e.c. (3559)	61.03	50.00	16.61
Industrial patterns (3565)	61.03	24.00	32.94
Aluminum rolling and drawing, n.e.c. (3355)	61.13	144.00	120.41
Machine tools, metal forming types (3542)	61.57	40.00	69.40
Metalworking machinery, n.e.c. (3549)	61.89	80.00	13.74
Nonelectrical machinery, n.e.c. (3599)	61.95	30.00	1617.89
BOAT BUILDING AND REPAIRING (3732)	62.29	75.00	26.84
Hand and edge tools, except machine tools (3423)	62.41	70.00	99.97
Household cooking equipment (3631)	62.42	480.00	2.75
Hand saws and saw blades (3425)	62.50	65.00	21.72
PRINTING TRADES MACHINERY (3555)	62.71	51.00	182.68
General industrial machinery, n.e.c. (3569)	63.82	60.00	81.74

Difference score from 3544 to National 3544 = 49.81

**Table 23****Crosswalk for  
Special dies, tools, jigs and fixtures**

SIC Code: 3544

SIC Description	Score	Median Employ	Market Size
Special dies, tools, jigs and fixtures (3544)	13.40	30.00	989.44
Machine tools, metal cutting types (3541)	29.60	55.00	124.02
Nonelectrical machinery, n.e.c. (3599)	31.70	30.00	1617.89
Machine tool accessories (3545)	31.78	40.00	385.57
Machine tools, metal forming types (3542)	32.40	40.00	69.40
Special industry machinery, n.e.c. (3559)	33.33	50.00	16.61
Industrial patterns (3565)	36.09	24.00	32.94
AIRCRAFT ENGINES AND ENGINE PARTS (3724)	36.88	132.00	2693.09
Paper industries machinery (3554)	36.92	58.00	1.97
Metalworking machinery, n.e.c. (3549)	37.23	80.00	13.74
AIRCRAFT EQUIPMENT, N.E.C. (3728)	37.96	98.00	5797.16
PRINTING TRADES MACHINERY (3555)	38.18	51.00	182.68
Turbines, and turbine generator sets (3511)	39.88	130.00	0.00
General industrial machinery, n.e.c. (3569)	40.06	60.00	81.74
ENGINEERING AND SCIENTIFIC INSTRUMENTS (3811)	41.67	74.00	227.93

Difference score from Michigan 3544 to National 3544 = 13.40

Median employment for Michigan 3544 = 25

million of tool & die products shipped to producers of aircraft engines and engine parts (SIC 3724) who ship products to makers of military aircraft (SIC 3728). Many of the estimated second tier markets are below an annual level of \$1 million. Even growth rates of 7-10% a year may not, then, generate a large number of contracts. It is recommended that tool & die firms consider only the largest of markets at this level where presumably competition is a factor in contracting. The larger markets would also be easier to locate for this reason.

### *Linked supplier markets for crosswalk entry*

The last column of table 22 lists almost \$2.8 billion in potential crosswalks supplier markets, at the first and second tier supply, for sourced to the 14 industries recommended to the Flint tool & die firm. Just one of these crosswalk industries, Industrial patterns (SIC 3565), is discussed in this section. The AM Inventory contains 22 records of SIC 3565 establishments and their average machine tool structure is shown in table 25. Table 20, which shows the machine tool structure of the Genesee tool & die firm can be compared with the percent contributions of machine tool types shown in table 25.

A comparison reveals that the Flint tool and die firm closely matches industrial pattern firms in terms of it's use of grinding, drilling, milling and cutoff machines. Yet, over 86% of industrial pattern firms reported the presence of turning machines which represented over 10% of their total machine tool endowment. Industrial patterns firms also do not appear to make use of mechanical presses, a special feature of the Flint tool & die shop, and possess a surprising number of NC turning machines and machining centers. Usually the presence of NC equipment, especially in the 1983 period, indicates a capacity requirement for high precision in production. These differences would further indicate that the difference score of over 61 calculated for this particular industry crosswalk may not imply a valid "closeness" in terms of the ease of the Flint firm entering this market.

It should be noted that Industrial patterns firms traditionally operate at the second tier of supply. The sum total of first tier opportunities for SIC 3565 firms is shown in table 26. These direct supplier markets only sum to \$11.2 million in 1986. An additional \$21.7 million in second tier supplier markets, connected to the final

Table 24

## Potential Customer Markets for Supplier 3544

## Special dies, tools, jigs and fixtures

## Tier 1 Analysis

Destination SIC	Market Value
Military aircraft (37211)	\$93.25
Aircraft engine parts & accessories (37244)	86.48
Aircraft parts & accessories, n.e.c. (37281)	70.34
Civilian aircraft (37212)	64.88
Search & detection, navigation & guidance systems (36625)	63.42
Electronic computing equipment (35731)	48.70
Other printing trade machinery & equipment (35555)	48.54
Peripheral equipment for computers (35732)	42.02
Parts and attachments for computers (35733)	24.86
Communications systems and equipment (ex. broadcasting) (36621)	23.49
Other electrical equipment for internal combustion engine (36945)	21.10
Unitary air conditioners (35852)	17.90
Telephone switchboard equipment (36611)	13.17
Aeronautical, nautical & navigational instruments (38111)	12.58
Testing equipment for electrical circuits & motors (38252)	12.04
R & D on aircraft parts (37283)	10.22
Aluminum cans (34112)	10.21
Commercial refrigeration equipment (35853)	8.99
Other sheet metal work (34446)	8.32
Electronic systems and equipment, n.e.c. (36627)	8.11
Surgical appliances and supplies (38421)	6.75
Ignition harness and cable sets (36941)	6.20
Electric razors and dry shavers (36342)	4.68
Metal doors and frames (ex. storm doors) (34421)	3.86
Commercial cooking and foodwarming equipment (35891)	3.42
Electronic computing equipment, n.s.k. (35730)	3.20
Fixtures for stores, banks, etc. (ex. wood) (25424)	2.52
Metal window sashes and frames (ex. storm sashes) (34422)	2.40
Electrical equipment, n.e.c, n.s.k. (36990)	2.36
Physical properties testing and inspection equipment (38292)	2.34
Binding machinery and equipment (35554)	2.04
Inboard-outdrive boats, except houseboats (37326)	1.86
Household vacuum cleaners, parts and attachments (36350)	1.71
Aircraft engine instruments, except flight (38291)	1.66

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Inboard motorboats (37325)	1.61
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	1.29
Household water heaters, except electric (36392)	1.28
Aircraft propellers (37285)	1.25
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	1.23
Construction machinery, n.s.k. (35310)	1.15
Parts for automatic merchandise machines (35812)	1.13
Golf equipment (39492)	1.04
Commercial and industrial vacuum cleaners (35893)	1.03
Household water heaters, electric (36391)	0.96
Mailing, letter handling, addressing machines (35795)	0.93
Industrial trucks and tractors, n.s.k. (35370)	0.90
Partitions, except wood (25421)	0.78
Other metal office furniture (25224)	0.76
Household laundry equipment, n.e.c. (36333)	0.70
Playground, gymnasium, and exercise equipment (39494)	0.70
Laminated aluminum foil flexible packaging (34972)	0.65
Partitions, shelving, lockers, and fixtures (ex. (25420)	0.63
Parts for small appliances (36344)	0.56
Golf carts and industrial personel carriers (37993)	0.55
Office storage units, files, and tables (ex. wood) (25223)	0.54
Metal office seating, incl. upholstered (ex. wood) (25221)	0.47
Surgical appliances and supplies, n.s.k. (38420)	0.37
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	0.33
Metal cans, n.s.k. (34110)	0.33
Venetian Blinds (25912)	0.28
Electronic hearing aids (38424)	0.25
Radio and TV receiving sets, n.s.k. (36510)	0.25
Prefabricated metal buildings, n.s.k. (34480)	0.13
<b>Total Market Value</b>	<b>\$755.50</b>

Industry size: 8567.8



Table 25

## Machine Tool Endowments

List of tool percent contributions for (3585)

## Industrial patterns

Machine Tool Description	Percent of Firms	Percent Contribution
NC TURNING MACHINES	18.18%	0.80
Horiz: 9-In To Under 13-In Chuck (10102)	13.64	0.57
NON-NC TURNING MACHINES	86.36%	9.30
Eng & Tlrm (Not Tracer) Over 8-In To 16-In Swing (10202)	68.18	3.10
Eng & Tlrm (Not Tracer) Over 16-In Swing (10203)	36.36	1.80
Tracer Lathes (All Sizes) (10204)	36.36	1.08
Turret Lathes (All Non-Nc) (10205)	18.18	0.80
NON-NC BORING MACHINES	27.27%	0.95
Hor Bore, Drl, Mill (Bar Mach) Table & Planer Type (10401)	9.09	0.50
NON-NC DRILLING MACHINES	77.27%	11.34
Vertical Upright (Hand Or Power Feed) (10601)	59.09	7.46
Radial (10602)	50.00	2.18
Multi-Spndl Cluster (Adj & Fxd Ctr) (10603)	18.18	1.70
NC MACHINING CENTERS	22.73%	2.08
Automatic Tool Chnag: Vert Y-Axis: Over 26-In (10702)	18.18	1.23
Automatic Tool Chnag: Horiz Y-Axis: Over 26In (10704)	9.09	0.88
NC MILLING MACHINES	27.27%	1.37
Gen Purpose, Knee Or Bed: Vertical (10802)	18.18	1.01
NON-NC MILLING MACHINES	86.36%	24.35
Gen Purpose, Knee Or Bed: Vertical (10902)	45.45	4.43
Gen Purpose, Knee Or Bed: Horizontal (10903)	36.36	1.02
Profiling And Duplicating (10905)	59.09	4.95
Die Sinking, Engraving, Pantograph (10906)	18.18	0.68
All Other Non-Nc Milling (10907)	13.64	1.34
NON-NC GRINDING MACHINES	72.73%	12.32
Surface: Reciprocating, Horiz, Hand (11207)	31.82	0.92
Tool And Cutter (11209)	45.45	1.84
Bench, Floor, And Snag (11210)	36.36	3.01
Disk Grinders, Single & Double Spndl (11211)	40.91	4.08
Abrasive Bell (Except Finishing) (11212)	36.36	1.67
TAPPING MACHINES	18.18%	0.99
Tapping Machines (11601)	18.18	0.99
CUTOFF & SAWING MACHINES	95.45%	11.87
Hacksaw (11801)	31.82	1.45
Circular Cutoff Saws (11802)	45.45	1.48
Abrasive Wheel (11803)	45.45	2.33
Bandsaw, Contour Sawing & Filing (11804)	86.36	6.20
ALL OTHER NON-NC METALCUTTING MACHINES	4.55%	1.94
All Other Non-Nc Metalcutting Machines (12301)	4.55	1.94

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NON-NC PUNCHING & SHEARING MACHINES Punching Machines (Incl Comb Punch-Shear) (20201)	18.18% 13.64	1.04 0.85
ALL OTHER NON-NC METALFORMING MACHINES All Other Non-Nc Metalforming Machines (21501)	4.55% 4.55	4.13 4.13
ELECTRIC ARC-WELDING EQUIPMENT Manual Weld Equip (No. Of Pwer Supplies) (30301)	59.09% 59.09	5.06 4.95
PLASTIC-MOLDING MACHINES Other (Incl Vacuum Forming, Rotational) (40103)	9.09% 4.55	1.33 1.30
HEAT-TREATING EQUIPMENT Furnaces: Batch (40301)	18.18% 13.64	0.82 0.76
CLEANING & FINISHING EQUIPMENT Shot, Abrasive & Other Blast Units (40503)	45.45% 36.36	2.45 2.11

Sample size: 22

## Table 26

### Potential Customer Markets for Supplier 3565

#### Industrial patterns

#### Tier 1 Analysis

Destination SIC	Market Value
Aeronautical, nautical & navigational instruments (38111)	\$6.41
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	4.07
Prefabricated metal buildings, n.s.k. (34480)	0.44
Other printing trade machinery & equipment (35555)	0.31
Total Market Value	\$11.23

Industry size: 601.8

**Table 27**

## Potential Customer Markets for Supplier 3545

## Machine tool accessories

## Tier 1 Analysis

Destination SIC	Market Value
Military aircraft (37211)	\$37.76
Aircraft engine parts & accessories (37244)	34.99
Aircraft parts & accessories, n.e.c. (37281)	28.40
Civilian aircraft (37212)	26.27
Search & detection, navigation & guidance systems (36625)	25.55
Electronic computing equipment (35731)	19.76
Other printing trade machinery & equipment (35555)	19.60
Peripheral equipment for computers (35732)	17.05
Parts and attachments for computers (35733)	10.09
Communications systems and equipment (ex. broadcasting) (36621)	9.46
Other electrical equipment for internal combustion engine (36945)	8.53
Unitary air conditioners (35852)	7.24
Telephone switchboard equipment (36611)	5.34
Aeronautical, nautical & navigational instruments (38111)	5.08
Testing equipment for electrical circuits & motors (38252)	4.86
Aluminum cans (34112)	4.15
R & D on aircraft parts (37283)	4.13
Commercial refrigeration equipment (35853)	3.64
Other sheet metal work (34446)	3.38
Electronic systems and equipment, n.e.c. (36627)	3.27
Surgical appliances and supplies (38421)	2.72
Ignition harness and cable sets (36941)	2.51
Electric razors and dry shavers (36342)	1.90
Metal doors and frames (ex. storm doors) (34421)	1.50
Commercial cooking and foodwarming equipment (35891)	1.38
Electronic computing equipment, n.s.k. (35730)	1.30
Fixtures for stores, banks, etc. (ex. wood) (25424)	1.02
Metal window sashes and frames (ex. storm sashes) (34422)	0.98
Electrical equipment, n.e.c, n.s.k. (36990)	0.95
Physical properties testing and inspection equipment (38292)	0.95
Binding machinery and equipment (35554)	0.82
Inboard-outdrive boats, except houseboats (37326)	0.75
Household vacuum cleaners, parts and attachments (36350)	0.70
Aircraft engine instruments, except flight (38291)	0.67

Inboard motorboats (37325)	0.65
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	0.52
Household water heaters, except electric (36392)	0.51
Aircraft propellers (37285)	0.51
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	0.49
Construction machinery, n.s.k. (35310)	0.47
Parts for automatic merchandise machines (35812)	0.46
Golf equipment (39492)	0.42
Commercial and industrial vacuum cleaners (35893)	0.42
Household water heaters, electric (36391)	0.38
Mailing, letter handling, addressing machines (35795)	0.38
Industrial trucks and tractors, n.s.k. (35370)	0.36
Partions, except wood (25421)	0.31
Other metal office furniture (25224)	0.31
Playground, gymnasium, and exercise equipment (39494)	0.28
Household laundry equipment, n.e.c. (36333)	0.28
Laminated aluminum foil flexible packaging (34972)	0.26
Partitions, shelving, lockers, and fixtures (ex. (25420)	0.25
Parts for small appliances (36344)	0.23
Golf carts and industrial personel carriers (37993)	0.22
Office storage units, files, and tables (ex. wood) (25223)	0.22
Metal office seating, incl. upholstered (ex. wood) (25221)	0.19
Surgical appliances and supplies, n.s.k. (38420)	0.15
Metal cans, n.s.k. (34110)	0.13
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	0.13
Venetian Blinds (25912)	0.11
Electronic hearing aids (38424)	0.10
Radio and TV receiving sets, n.s.k. (36510)	0.10
Total Market Value	\$305.54

Industry size: 3464.4

**Table 28**

**Crosswalk for  
Machine tool accessories**

SIC Code: 3545

SIC Description	Score	Median Employ	Market Size
Machine tool accessories (3545)	14.73	40.00	385.57
Machine tools, metal cutting types (3541)	24.00	55.00	124.02
Special dies, tools, jigs and fixtures (3544)	30.26	30.00	989.44
Nonelectrical machinery, n.e.c. (3599)	31.09	30.00	1617.89
Machine tools, metal forming types (3542)	32.64	40.00	69.40
AIRCRAFT EQUIPMENT, N.E.C. (3728)	34.48	98.00	5797.16
AIRCRAFT ENGINES AND ENGINE PARTS (3724)	35.90	132.00	2693.09
Power driven hand tools (3546)	36.98	140.00	16.36
Special industry machinery, n.e.c. (3559)	37.02	50.00	16.61
PRINTING TRADES MACHINERY (3555)	37.27	51.00	182.68
Internal combustion engines, n.e.c. (3519)	38.90	300.00	317.70
Paper industries machinery (3554)	39.40	58.00	1.97
ENGINEERING AND SCIENTIFIC INSTRUMENTS (3811)	40.61	74.00	227.93
OPTICAL INSTRUMENTS AND LENSES (3832)	40.76	43.00	0.00
General industrial machinery, n.e.c. (3569)	41.19	60.00	81.74

Difference score from Michigan 3545 to National 3545 = 14.73

Median employment for Michigan 3545 = 32

machine tool accessories firms of 58.6, the lowest crosswalks score found for that firm with any industry.

#### *Linked supplier markets for direct entry*

A total of \$305 million in high growth first tier supplier markets were identified for SIC 3545 firms through the use of Input-Output matrix of the Bureau of Economic Analysis. Markets greater than \$100,000 in value, in 1986, are shown in table 27. Eight of these markets are annually greater than \$10 million in shipments. They include several very high-growth computer related markets (SICs 35731, 35732-33). Computer-related markets have been linked to some of the most successful, actual product change cases experienced by Michigan manufacturers who were prior auto-market suppliers. The \$305 million in first tier markets identified in table 27 constitute less than 10% of the total shipments of SIC 3545 establishments in 1986.

An additional \$80 million in second tier markets for SIC 3545 firms are presents in table A-27 in Appendix 1. The list of related first tier industries linked to SIC 3545 are striking similar to the list of industries linked to SIC 3544 in table A-24.

#### *Linked supplier markets for crosswalk entry*

Table 29 contains crosswalks results for the AM subsample of Michigan machine tool accessories firms (respondent count of 71). The matching Scores for this subsample to other industries were generally very low: a positive indicator of "closeness" as a group. The total sum of markets identified that are linked to the crosswalks industries at the first and second tier is \$12.1 billion. Five (capitalized) final use markets are identified in addition to the supplier markets. The Michigan subsample of machine tool accessories firms closely match other machine tool making industries, as well as producers of aircraft parts, engines and equipment.

#### **SICs 3451-2: Screw machine products**

U.S. Screw Machine Product manufacturers shipped over \$8 billion in product in 1988 according to the U.S. Department of Commerce. This level of shipments is a 15% increase over total sales in 1987. While a considerable portion of total shipments for this industry group were

sold to auto manufacturers, other major gains in market were made in supplying a wide variety of machinery manufacturers who experienced an upturn in export sales as a result of a weak U.S. dollar. Despite an unfavorable trend for automotive contracts, which will affect primarily screw machine products shops (SIC 3451), and heavy pressure from importers of fasteners (33% of SIC 3452 domestic market), the Department of Commerce forecasts favorably annual growth in shipments of 2-3% a year for both industries through 1993.

### *Linked supplier markets for direct entry*

The 1986 *County Business Patterns* publication of the U.S. Census reports the presence of 7 screw machine products establishments with employment greater than 9 in Genesee County. The Input-Output Matrix analysis is performed for both SIC 3451 and 3452 combined and the tier one direct supplier results are shown in table 29. No less than 13 of the direct supplier markets were estimated as greater than \$25 million in shipments in 1986. Markets greater than \$100,000 summed to over \$1.2 billion dollars that year. Table 29 results are surprising in that the largest markets seem to be linked to aircraft, computer, and telecommunications manufacturing, and not to the traditional industrial and construction machinery producing industries favored by the U.S. Department of Commerce. This is important finding in that the largest first tier supplier markets rank among the fastest growing of all the products markets listed in table 3. An additional \$331 million of second tier supplier markets were identified for SICs 3451-2 and are show in Table A-29 in Appendix 1.

### *Linked supplier markets for crosswalk entry*

The AM Inventory contains large subsamples of Michigan Screw Machine Products firms (241 record count) and fastener firms (121 record). Two separate crosswalks result tables are calculated for each 4-digit industry and shown in tables 30 and 31. Potential crosswalks supplier markets listed in the two tables sum to an impressive \$17.5 billion in 1986 shipments. The two lists, however, are quite similar in terms of the industries listed. This would imply that somewhat less than half of the sum of \$17.5 billion is double-counted. A number of the recommended industries are characterized by high median employment levels in the typical facility and a focussed on the



**Table 29**

## Potential Customer Markets for Supplier 3450

## Screw machine products, bolts, nuts

## Tier 1 Analysis

Destination SIC	Market Value
Search & detection, navigation & guidance systems (36625)	\$164.40
Military aircraft (37211)	146.96
Aircraft parts & accessories, n.e.c. (37281)	136.33
Civilian aircraft (37212)	102.25
Communications systems and equipment (ex. broadcasting) (36621)	60.90
Electronic computing equipment (35731)	57.08
Peripheral equipment for computers (35732)	49.26
Aircraft engine parts & accessories (37244)	34.91
Surgical appliances and supplies (38421)	30.14
Testing equipment for electrical circuits & motors (38252)	29.41
Parts and attachments for computers (35733)	29.14
Unitary air conditioners (35852)	27.96
Telephone switchboard equipment (36611)	26.41
Other electrical equipment for internal combustion engine (36945)	23.95
Electric razors and dry shavers (36342)	23.35
Aeronautical, nautical & navigational instruments (38111)	23.12
Other sheet metal work (34446)	21.50
Electronic systems and equipment, n.e.c. (36627)	21.03
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	20.73
R & D on aircraft parts (37283)	19.81
Other printing trade machinery & equipment (35555)	16.89
Mailing, letter handling, addressing machines (35795)	14.34
Commercial refrigeration equipment (35853)	14.05
Household vacuum cleaners, parts and attachments (36350)	13.68
Metal doors and frames (ex. storm doors) (34421)	12.54
Physical properties testing and inspection equipment (38292)	12.39
Fixtures for stores, banks, etc. (ex. wood) (25424)	9.68
Other metal office furniture (25224)	9.37
Aircraft engine instruments, except flight (38291)	8.75
Metal window sashes and frames (ex. storm sashes) (34422)	8.21
Venetian Blinds (25912)	7.81
Golf equipment (39492)	7.59
Ignition harness and cable sets (36941)	7.04
Office storage units, files, and tables (ex. wood) (25223)	6.71

Commercial cooking and foodwarming equipment (35891)	6.36
Household water heaters, except electric (36392)	6.32
Metal office seating, incl. upholstered (ex. wood) (25221)	5.79
Household laundry equipment, n.e.c. (36333)	5.55
Inboard-outdrive boats, except houseboats (37326)	5.47
Playground, gymnasium, and exercise equipment (39494)	5.08
Inboard motorboats (37325)	4.74
Household water heaters, electric (36391)	4.73
Electronic computing equipment, n.s.k. (35730)	3.75
Parts for automatic merchandise machines (35812)	3.31
Partions, except wood (25421)	2.98
Parts for small appliances (36344)	2.81
Construction machinery, n.s.k. (35310)	2.67
Aircraft propellers (37285)	2.43
Partitions, shelving, lockers, and fixtures (ex. (25420)	2.40
Prefabricated metal buildings, n.s.k. (34480)	2.26
Commercial and industrial vacuum cleaners (35893)	1.92
Surgical appliances and supplies, n.s.k. (38420)	1.65
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	1.62
Industrial trucks and tractors, n.s.k. (35370)	1.45
Golf carts and industrial personel carriers (37993)	1.44
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	1.31
Electronic hearing aids (38424)	1.12
Radio and TV receiving sets, n.s.k. (36510)	0.89
Binding machinery and equipment (35554)	0.71
<b>Total Market Value</b>	<b>\$1276.43</b>

Industry size: 7182.6

**Table 30****Crosswalk for  
Screw machine products**

SIC Code: 3451

SIC Description	Score	Median Employ	Market Size
Screw machine products (3451)	17.70	37.00	0.00
Power driven hand tools (3546)	45.26	140.00	16.36
Valves and pipe fittings (3494)	45.79	83.00	162.19
Nonelectrical machinery, n.e.c. (3599)	47.97	30.00	1617.89
Carburetors, pistons, piston rings, and valves (3592)	48.18	87.00	245.79
Power transmission equipment, n.e.c. (3568)	48.93	60.00	117.67
Ball & roller bearings (3562)	49.80	125.00	488.43
Internal combustion engines, n.e.c. (3519)	50.23	300.00	317.70
Hand and edge tools, except machine tools (3423)	50.41	70.00	99.97
Bolts, nuts, screws, rivets, and washers (3452)	50.50	55.00	0.00
Plumbing fixture fittings and trim (brass) (3432)	51.30	150.00	1.51
Machine tools, metal cutting types (3541)	51.35	55.00	124.02
Motor vehicle parts and accessories (3714)	51.81	160.00	47.02
ENGINE ELECTRICAL EQUIPMENT (3694)	51.88	200.00	384.39
Machine tool accessories (3545)	51.91	40.00	385.57

Difference score from Michigan 3451 to National 3451 = 17.70

Median employment for Michigan 3451 = 33

**Table 31****Crosswalk for  
Bolts, nuts, screws, rivets, and washers**

SIC Code: 3452

SIC Description	Score	Median Employ	Market Size
Bolts, nuts, screws, rivets, and washers (3452)	30.00	55.00	0.00
Ball & roller bearings (3562)	49.31	125.00	488.43
Machine tool accessories (3545)	50.68	40.00	385.57
Carburetors, pistons, piston rings, and valves (3592)	50.74	87.00	245.79
Power driven hand tools (3546)	50.75	140.00	16.36
Motor vehicle parts and accessories (3714)	52.22	160.00	47.02
Hand and edge tools, except machine tools (3423)	52.66	70.00	99.97
AIRCRAFT EQUIPMENT, N.E.C. (3728)	52.81	98.00	5797.16
Machine tools, metal cutting types (3541)	53.23	55.00	124.02
AIRCRAFT ENGINES AND ENGINE PARTS (3724)	54.32	132.00	2693.09
Motors & generators (3621)	54.77	250.00	1419.42
Power transmission equipment, n.e.c. (3568)	54.95	60.00	117.67
Nonelectrical machinery, n.e.c. (3599)	55.53	30.00	1617.89
Hardware, n.e.c. (3429)	55.69	60.00	413.64
Environmental controls (3822)	55.80	75.00	152.01

Difference score from Michigan 3452 to National 3452 = 30.00

Median employment for Michigan 3452 = 45

production of highly complex products. Since the typical Screw Machine Products facility is quite small and limited in complexity of the work it can attempt, the crosswalks recommendations need to be carefully investigated and screened prior to any serious direct marketing effort.

#### **SIC 3599: Nonelectrical Machinery, n.e.c.**

The 1986 *County Business Patterns* publication of the U.S. Census reports the presence of 10 miscellaneous nonelectrical machinery establishments with employment greater than 9 in Genesee County. This industry traditionally produces miscellaneous machinery components and parts not easily classified into special industry machinery classifications. SIC 3599 firms also perform repair work on a variety of equipment types on a contract basis. Genesee County contains a large number of these facilities given the size of its manufacturing base. The presence of these firms may be connected to special needs and demands of the large GM facilities who may require special machining, repair or modeling work performed outside to support plants operations and product development.

#### ***Linked supplier markets for direct entry***

The Miscellaneous machinery industry may possess more linkages to the end-use product markets than any other metalworking industry considered in crosswalks. Table 32 lists the potential first tier supplier markets which sum to a total shipments level of almost \$1.3 billion in 1986. The largest direct supplier markets in table 32 are associated with the aircraft manufacturing industries. It is highly probably that these market opportunities are mostly made up of various repair contracts with the national air carriers. If so, Genesee firms would, at this time, be at a geographic disadvantage. The remaining markets span the gamut of the products listed in table 3.

An additional \$493 million in second tier supplier markets were directly linked to SIC 3599 firms through the use of input-output analysis. The first tier customers include many of the same industries identified as first tier customers for SIC 3599. The specific markets are shown in table A-32 in Appendix 1.

#### ***Linked supplier markets for crosswalk entry***

**Table 32**

Potential Customer Markets for Supplier 3599

Nonelectrical machinery, n.e.c.

Tier 1 Analysis

Destination SIC	Market Value
Military aircraft (37211)	\$164.51
Other printing trade machinery & equipment (35555)	160.72
Aircraft parts & accessories, n.e.c. (37281)	124.30
Search & detection, navigation & guidance systems (36625)	116.01
Civilian aircraft (37212)	114.46
Aircraft engine parts & accessories (37244)	108.10
Electronic computing equipment (35731)	44.51
Communications systems and equipment (ex. broadcasting) (36621)	42.98
Unitary air conditioners (35852)	40.01
Peripheral equipment for computers (35732)	38.41
Surgical appliances and supplies (38421)	30.93
Testing equipment for electrical circuits & motors (38252)	28.56
Aeronautical, nautical & navigational instruments (38111)	26.01
Parts and attachments for computers (35733)	22.72
Commercial refrigeration equipment (35853)	20.11
Telephone switchboard equipment (36611)	19.75
R & D on aircraft parts (37283)	18.06
Electronic systems and equipment, n.e.c. (36627)	14.84
Aluminum cans (34112)	12.67
Electric razors and dry shavers (36342)	12.07
Inboard-outdrive boats, except houseboats (37326)	9.58
Commercial cooking and foodwarming equipment (35891)	8.96
Inboard motorboats (37325)	8.31
Metal doors and frames (ex. storm doors) (34421)	7.85
Other sheet metal work (34446)	7.66
Binding machinery and equipment (35554)	6.75
Industrial trucks and tractors, n.s.k. (35370)	6.38
Mailing, letter handling, addressing machines (35795)	5.68
Other electrical equipment for internal combustion engine (36945)	5.25
Metal window sashes and frames (ex. storm sashes) (34422)	5.14
Prefab metal industrial & commercial bldgs (ex. farm & residential) (34481)	4.30
Fixtures for stores, banks, etc. (ex. wood) (25424)	2.99
Parts for automatic merchandise machines (35812)	2.95
Electronic computing equipment, n.s.k. (35730)	2.92

Physical properties testing and inspection equipment (38292)	2.72
Commercial and industrial vacuum cleaners (35893)	2.71
Construction machinery, n.s.k. (35310)	2.31
Noninsulated ferrous wire rope, cable, etc., not prod. by wire drawers (34961)	2.29
Aircraft propellers (37285)	2.21
Aircraft engine instruments, except flight (38291)	1.92
Household vacuum cleaners, parts and attachments (36350)	1.73
Surgical appliances and supplies, n.s.k. (38420)	1.69
Other metal office furniture (25224)	1.61
Ignition harness and cable sets (36941)	1.54
Parts for small appliances (36344)	1.45
Golf equipment (39492)	1.42
Office storage units, files, and tables (ex. wood) (25223)	1.15
Electronic hearing aids (38424)	1.14
Laminated aluminum foil flexible packaging (34972)	1.13
Electrical equipment, n.e.c, n.s.k. (36990)	1.09
Metal office seating, incl. upholstered (ex. wood) (25221)	0.99
Playground, gymnasium, and exercise equipment (39494)	0.95
Partions, except wood (25421)	0.92
Golf carts and industrial personel carriers (37993)	0.86
Partitions, shelving, lockers, and fixtures (ex. (25420)	0.74
Electrical industrial apparatus, n.e.c., n.s.k. (36290)	0.52
Venetian Blinds (25912)	0.50
Household water heaters, except electric (36392)	0.49
Prefabricated metal buildings, n.s.k. (34480)	0.47
Metal cans, n.s.k. (34110)	0.40
Household laundry equipment, n.e.c. (36333)	0.39
Radio and TV receiving sets, n.s.k. (36510)	0.37
Household water heaters, electric (36391)	0.36
Total Market Value	\$1280.52

Industry size: 14207.3

**Table 33****Crosswalk for  
Nonelectrical machinery, n.e.c.**

SIC Code: 3599

SIC Description	Score	Median Employ	Market Size
Nonelectrical machinery, n.e.c. (3599)	17.62	30.00	1617.89
Machine tools, metal cutting types (3541)	18.78	55.00	124.02
Machine tool accessories (3545)	23.23	40.00	385.57
AIRCRAFT EQUIPMENT, N.E.C. (3728)	24.53	98.00	5797.16
Machine tools, metal forming types (3542)	26.28	40.00	69.40
PRINTING TRADES MACHINERY (3555)	27.22	51.00	182.88
AIRCRAFT ENGINES AND ENGINE PARTS (3724)	27.43	132.00	2693.09
Special industry machinery, n.e.c. (3559)	29.55	50.00	16.81
Special dies, tools, jigs and fixtures (3544)	29.64	30.00	989.44
General industrial machinery, n.e.c. (3569)	29.97	60.00	81.74
Metalworking machinery, n.e.c. (3549)	30.08	80.00	13.74
Power transmission equipment, n.e.c. (3568)	30.14	60.00	117.67
Textile machinery (3552)	30.23	50.00	2.76
Paper industries machinery (3554)	30.48	58.00	1.97
Power driven hand tools (3546)	30.59	140.00	16.36

Difference score from Michigan 3599 to National 3599 = 17.62

Median employment for Michigan 3599 = 30



A Michigan subsample of 89 SIC 3599 establishments were matched in the crosswalks analysis first to the 1,280 records comprising the national sample of miscellaneous machinery firms in the AM Inventory. The matching Score of 17.62 is surprisingly low considering the variety of products produced in this industry. A number of other low scores are achieved when the Michigan subsample is matched with other special industrial machinery industries. The potential supplier markets connected to these other industries total to almost \$10.5 billion in 1986.

## VI. Conclusions and Recommendations

The stated goal of this report is to identify new, attainable product markets for manufacturing establishments in Genesee County. The following observations can be made regarding the extent to which this goal was achieved:

- The 67 fastest growing manufacturing product markets in the United States during the 1972-1986 period were identified. These products were selected from a list of 421 product groups, out of an overall list of 1,600+ manufacturing product groups, that require the significant use in production of metalworking intermediate goods and services.
- The most important metalworking supplier markets directly and indirectly linked to the 67 product groups were identified and their shipment levels estimated for 1986. It is assumed that these supplier markets will grow at the same rate as shipments of the final-use products.
- A method is implemented to recommend specific targets for industrial mobility (crosswalks) to Genesee manufacturing establishments. These recommendations are meant to allow the firms to consider opportunities not only in their traditional industries, but also supplier markets linked to other industries. The recommendations are based on the individual facility's similarity in machine tool usage to that characteristic of other likely industries (machine tool requirements analysis).
- Analyses are carried out for a selection of GM facilities contained in the AM Inventory, as well as for the largest industry groups in the non-GM manufacturing industry groups in Genesee County.

The following observations can be made regarding the extent to which the stated goal of this report was not achieved:

- The full range of potential product market opportunities identified in the analysis are not presented in this report. A listing of the almost 20,000 markets would take almost 200 pages and would serve little purpose in illustrating the method or providing tailored recommendations to specific Genesee client manufacturers. It is hoped

that custom reports will be made available to specific Genesee facilities in the dissemination portion of this project.

- The trend analysis used in the final use product selection did not make use of the most recent information on annual shipments. The 1987 Census of Manufacturing results were not available at the time the analysis was performed. It is strongly recommended that if any wider plan is adopted in the near future for using the crosswalks method in Genesee., that this data be acquired and the trending analysis performed again. Complete and current information on trends in products shipments is critical to the validity and usefulness of this project.

- Actual product market descriptions in this report are limited to the level of government product and industrial classifications. The detailed identification and description of physical products and even potential customer firms and regions was not attempted in this report. This was so for two reasons. First, individual Genesee manufacturers and/or regional economic authorities may not need or want information at this level of detail. This report offers a gain in the efficiency of market research by providing initial screening of an almost unlimited number of individual firm markets in the United States. Second, the level of effort required for detailed descriptions of actual product market opportunities would require resources far beyond those supplied to this project. Specific identification of contract or job opportunities should be left to the manufacturers themselves, or to interested, and funded, regional local authorities who have skill in this area. The need for such services will be a special focus of the planned seminar for Genesee tool & die manufacturers.

A dissemination seminar for this project will be held. The target Genesee industry is SIC 3544-45, or tool & die manufacturing. Seminar participants will be asked to provide a complete listing of their respective facilities' machine tool endowments. They can provide this information in form of their own standard machine listing or by completing the endowment questionnaire contained in Appendix 2. The participants will also be asked to provide some history of their product experience: what industries have they supplied and in what proportion, what materials have they used, and what operations/processes they have experience in performing. In return for this information, each participant will be provided with a copy of this report and will receive a customized listing of direct entry and crosswalk market opportunities