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The structure of international music flows using network analysis

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Abstract
Using network analysis, this study examines the current structure of international music trade flow and its determinants. International music trade data from the United Nations Commodity Trade Statistics database are employed to describe the international music flow network and how it changed between 2002 and 2006. Network analysis reveals the imbalance of international music trade between the core and the periphery. Specifically, the USA and European countries including Germany, the UK and the Netherlands are at the core, dominating international trade of music products. Over the five-year period, the international music trade network remained relatively stable. Regression analysis indicates that a country's economic development, the language(s) its people speak and technological development are influential factors that determine the global structure of international music flows.

Key words
cultural imperialism, globalization, media dependency, music industry, network analysis, record company, trade

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Introduction

Many scholars and musicians propose that popular music is one of the most universal means of communication, traversing language and other cultural barriers (Burnett, 1996; Chaffee, 1985; Robinson, 1986). In recent years, the development of new communication technologies has changed the music industry, including the production, distribution and consumption of music goods. Specifically, information networks such as the internet have provided the ability for individuals, organizations and nations to exchange and distribute information by eliminating national boundaries and geographical separation (Kretschmer et al., 2001). Accordingly, some studies have examined whether new technologies (e.g. digital compression, peer-to-peer networks and the increasing pervasiveness of the internet and broadband connections) affect individuals' traditional music consumption behavior (Jones and Lenhart, 2004; Molteni and Ordanini, 2003), while others focus on why individuals engage in illegal downloading behavior (Chiou et al., 2005; LaRose and Kim, 2007). At a national level, several economists have investigated whether the emergence of new music technologies influences some countries' domestic markets or sales (Oberholzer and Strumpf, 2007; Zentner, 2006).

To date, however, very few studies have taken an international perspective in studying how the new technologies have changed the global structure of international music flows. It remains unclear whether the evolution of information and communication technologies has influenced the trade of music products on the international level. More importantly, although a few studies have attempted to examine the effects of new technologies on the global music market (for exceptions, see Kretschmer et al., 2001; Leyshon et al., 2005), they have shown little systematic analysis. In fact, the paucity of systematic and comprehensive studies is due in part to the ambiguity and lack of statistical data on international music trade.

Recognizing the lack of existing studies on the patterns of international music flow, this research presents an alternative perspective on international music trade by using various network analysis techniques. The purpose of this study is to examine the current structure of international music flow and to explore structural changes and trends in the international music trade network in recent years. In addition, this study specifies what factors determine the global structure of international music flow, based on previous research in this area.

Theoretical perspectives

The world system theory and cultural imperialism

World system theory provides a conceptual framework based on interaction activities among nations at a macro level (Chase-Dunn and Grimes, 1995; Wallerstein, 1979). More specifically, world system theory focuses on the economic relationship between the developed countries and developing countries, classifying three types of structurally equivalent nations: the core, the periphery and the semi-periphery. According to Barnett (2002), the world system perspective assumes that all countries are interrelated and linked in the global economic system and any change in an individual country is a result of events in the world system. Compared to the world system theory, Galtung's (1971) structural theory of imperialism argues that the structure of global imperialism is not solely determined by economic differences between the center and peripheral countries, but by elements of

imperialism based on the five types of exchange: (1) economic, (2) political, (3) military, (4) communication and (5) cultural.

Consistent with world system theory and Galtung's theory, previous literature on global media industries shows the general tendency for larger and wealthier countries to account for larger proportions of exports: (1) international trade in cultural products is vertical between center and peripheral nations, (2) a dominance relation between developed countries and developing countries is salient and (3) the imbalance in the international media trade is related to economic differences between the center and peripheral countries in the global economic system (Boyd-Barrett, 2001; Burnett, 1996; Chalaby, 2003; Kim and Barnett, 1996; Wallerstein, 1979). In this sense, the world system and Galtung's theory of imperialism provide systemic models of international trade or transactions which can be applied to the study of international music flow and its flow structure.

Global interaction and international music flow

The flow of information, ideas and cultural products on a global scale has greatly increased in recent decades, due in part to the many developments of new communication technology. According to Robertson (1992), the world is becoming a more unified place as a consequence of globalization. McLuhan (1966) labeled this phenomenon the 'global village'. Globalization means that information, as well as material goods, are liberally and frequently exchanged between different actors across national and cultural boundaries. One of the major arguments in support of globalization as a structural process is seen as international integration through trade (Chase-Dunn et al., 2000). The core countries have taken structural and accumulative advantage of their relatively superior positions in the world order. Many empirical studies have found this pattern to be common across a number of different types of international flows including trade, internet traffic flows, international telecommunication traffic and electronic transaction of financial information (Barnett and Choi, 1995; Barnett et al., 1999, 2001; Lee et al., 2007).

It is important to note that globalization leads to transnational media concentration as corporations attempt to expand and control international markets (Burnett; 1996; Chalaby, 2003; McQuail, 2005; Stokes, 2004). Recently, the dominance of four biggest music companies – Warner Music, Universal Music Group, EMI and Sony/BMG Entertainment – may be one of the most representative examples of internationalization and concentration of media ownership and control as a consequence of media globalization. The global music industry structure is characterized by oligopolistic patterns. These large companies have maintained their power and control through a series of merger and acquisition and vertical integrations.

Empirical evidence for the imbalance between the developed and the developing countries

Numerous empirical studies have been conducted to examine patterns of international trade in cultural products, including films (Frank, 1992; Fu, 2006; Guback, 1977; Wildman and Siwek, 1988), television (Waterman, 1988; Waterman and Rogers, 1994) and international news (Kim and Barnett, 1996; Wu, 2000). General results of the studies include the finding that international media products, on the whole, tend to flow from the

developed to the developing countries. For example, Wildman (1995) found that a small number of countries, especially the USA, dominated trade in film and television programs. The author described the USA's media trade domination as a *one-way international flow*. Also, Wildman and Siwek's (1993) study determined that there were similar patterns of US dominance in international trade of films and recorded music.

International trade statistics such as the UN Commodity Trade data (2007a) indicate that highly developed countries such as the USA and European countries are major exporters of cultural goods, including films, music, books and periodicals. The data indicate that the developing countries are the importers of cultural products, whereas a small number of the developed countries are the dominant exporters. Consistent with these data, research in the music recording industry shows that the global music market is dominated by the developed countries, including the USA, Germany, the UK, the Netherlands, France and Japan (Alexander, 1994; Bishop, 2005; UNCTAD, 2008).

Two recent statistical reports provide empirical evidence supporting an asymmetrical international music flow and a high concentration of a small number of transnational music conglomerate corporations. A recent International Federation of Phonographic Industry statistic (IFPI, 2007) reports the total music sales of individual countries by market for 2006. The report shows that the USA, Japan, the UK and Germany were ranked as the top four countries for total music sales in 2006. Regarding major global record companies, an OECD report indicates that the four major music labels control more than 80 percent of the global market (OECD, 2005). These findings imply that these four dominant record companies have expanded their influence over the major physical distribution chains, whereas independent record labels should depend on these international distribution networks.

Determinants of international music trade flow

To understand and identify the factors involved in the international trade of cultural products, several different theoretical perspectives have been suggested. In the media economics approach, the imbalance of international media flow between the developed and the developing countries has been regarded as the mechanism of fundamental market conditions (Hoskins and Mirus, 1988; Hoskins et al., 1997). For example, according to Wildman (1995), the degree of a country's media trade is determined by both the size of the domestic market and its media policies. The author argues that the USA's one-way international flows in films and television programs may be due to the relatively enormous size of the USA's media markets and more favorable policies toward commercialization. In terms of international music trade, countries with relatively large and wealthy domestic markets for music products have an advantage in exporting their music goods. In contrast to this home economic model, the frameworks of dependency and world system theory suggest that the asymmetric international flow of cultural products is determined by the structure of the capitalist world economy (Barnett, 1999, 2002; Wallerstein, 1974). For example, a country's media trade volume is determined by the positions of individual nations in the global interaction system structured into a center–peripheral relationship. Thus, these perspectives emphasize the relationships among the nations in the network, instead of individual nations' attribution. However, most studies have proposed that other factors (e.g. cultural,

religious, linguistic and geographical), as well as economics, best explain and predict international media trade patterns, irrespective of diverse theoretical perspectives.

Economic development

The economic factor is one of the most commonly accepted variables for predicting international media trade. Many studies have explored the relationship between economic development and the international media trade. Marvasti (1994) showed that countries with high gross national products (GNP) tend to export cultural products to other countries. In addition, the study found that the size of the domestic market plays a significant role in determining trade patterns in the film and record industries. Similarly, Waterman and Rogers' (1994) national broadcast television networks study revealed the proportion of domestic programs in East Asia was associated with gross domestic products (GDP).

Language as a cultural variable

Recent research has concluded that one-dimensional approaches are inadequate to describe the complexities of international communication and trade (Barnett, 2002; Fu, 2006; Kim and Barnett, 1996; Rauch, 1996). For example, Rauch (1996) proposed a network perspective of international trade in differentiated products such as cultural goods, assuming proximity and common language/colonial ties are more important for differentiated products than for undifferentiated products. Fu's (2006) international film import study categorized five dichotomous dummy variables (English, French, German, Spanish and Chinese) to test language's effect on foreign film imports. He found that the use of English leads to a greater dependence on American films, compared to other languages' use.

Population

Population may be another key predictor determining international media trade because population size creates economies of scale (Marvasti, 1994). Music, like other cultural products, can be characterized by scale economies because of its high fixed costs and low marginal costs of distribution (Owen and Wildman, 1992). A nation's domestic market size for music is related to its population. Likewise, Waterman (1988) examined the movie infrastructures of six countries, including the USA, France, Germany, Italy, the UK and Japan, and found the large population of the USA affects American dominance in the film industry.

Technological development

In the international trade literature, very few studies have attempted to examine how computer-communication technology and information networks have changed the structure of international music flow (Varis, 1984). Varis suggested that future study of the international media trade would need to include communication technology to better understand the unequal exchange between the information-rich and the information-poor countries. Furthermore, a recent study indicates that the structure of the international

telecommunication network and other communication flows such as television programming has similar patterns (Lee et al., 2007).

Research questions

Based upon previous research on international media trade, the current study investigates the structure of international music trade flow and structural changes in the global music network between 2002 and 2006. In addition, this research examines various determinant factors influencing the global structure of international music flow. The following research questions are posed:

RQ1: What is the global structure of international music flow?
RQ2: How has it changed over time, in terms of a core–periphery model?
RQ3: What factors have an effect on the global structure of international music flow?

Method

Data

International music trade International music trade data are published annually in the United Nations' Commodity Trade Statistics. Data from the United Nations Comtrade Database on global music trade (http://unstats.un.org/unsd/comtrade/) were employed to describe the global structure of international music flow. Each country reports with whom it exports and imports music products. The trade amounts are reported in US dollars. To date, a total of 141 countries reported their degree of international music trade between 2002 and 2006. However, fewer than half of the total countries reported without any missing year (i.e. only 67 countries consistently reported their music trade volume from 2002 through 2006). To include the greatest number of countries, data for 2004 were selected. In 2004, a total of 124 different countries reported both their exports and imports of only tangible music goods (e.g. records, CD, magnetic tape and other recorded media for sound). Because of the limitations of available trade data, other revenues from intangible musical forms are not included in measuring international music trade flows.

GDP Gross domestic product data were collected from the United Nations Common Database (UN, 2007b). GDP might be considered an important indicator that predicts international music trade flows.

Population It can be expected that the larger a country's population, the greater its domestic market size for music. In terms of the economies of scale, a country's population size might be associated with its international music trade. The data were obtained from the United Nations (2004) *Demographic Yearbook*.

Language Previous literature has shown that a variety of methods were employed in determining the language variable. For example, whereas some studies (Marvasti, 1994; Wildman and Siwek, 1988) categorized individual nations into two language groups, others employed a measure of English fluency assessed as the percentage of a

national population that is English fluent (Dupagne and Waterman, 1998; Jayakar and Waterman, 2000).

For this study, language data were categorized into two groups, with a score of 1 if a nation uses English, German, French, Spanish or Portuguese as its official language, and 0 if it used other languages as the official language. Data for languages were obtained from the CIA World Factbook (2005).

Internet use Internet users per 1000 population were drawn from the World Development Indicators database, which displays cross-country development data. Pervasive internet use has changed the way in which people consume music. Barnett (2002) suggested that the international telecommunications infrastructure may be related to patterns of international media use. Therefore, the internet use variable could affect international music flow.

Network analysis

Network analysis is a set of research procedures for identifying structures in systems based on the relations among its components, rather than the attributes of individual cases (Rogers and Kincaid, 1981; Wasserman and Robins, 2004). The method provides useful tools for describing the structure of global-level interactions such as international telecommunication and trade networks (Barnett and Choi, 1995; Barnett and Salisbury, 1996; Barnett et al., 1999). This article describes the structural relations among nations based on the total trade amounts of only tangible music products between the countries. Stated differently, international music flow is operationalized as the amount of dollars of physical music goods traded among the nations of the world.

The basic network dataset is an $n \times n$ matrix S, where n is equal to the number of nodes in the network. A node can represent different types of actors such as individuals, organizations or nations from which the system is composed. Each cell s_{ij} specifies the strength of the relation between node i and j. In this study, nations are the nodes, and the relationship is the degree of international music products traded. In other words, the trade data are entered into a nation by a nation matrix with out-degree data (e.g. the amount of export) on the left side of the diagonal and in-degree data (e.g. the amount of import) on the right side of the diagonal.

Degree centrality Centrality measures indicate the power attached to the position in the communication network (Borgatti et al., 2002). In this study, degree centrality was employed. Degree centrality represents the number of links (ties) an actor (e.g. a nation) has to other actors in the network. If actors have many links to other actors, they may have advanced positions in exchange of information in the communication network (Hanneman and Mark, 2005).

Cluster analysis Cluster analysis can be used to find groups based on amount of music trade between nations (Kim and Barnett, 1996). It identifies those groupings or clusters of nodes that best represents their measured relations. In this study, Johnson's hierarchical cluster analysis from the UCINET 6 program (Borgatti et al., 2002) was used.

Quadratic assignment procedure QAP (Borgatti et al., 2002) may be used to evaluate the strength of the relationship between each pair of networks. The network structures of each of the five study years are compared to one another using this technique.

Multiple regression analysis

The relation between the determinants and network structure of international music flow can be examined through multiple regression analysis. In particular, GDP, language dummy variables, population size and internet use may be used as independent variables to explain the structure of the international music flow network. With regard to dependent variables, a set of degree centrality can be used in this study.

Results

RQ1: description of international music flow in 2004

Table 1 presents 124 countries' degree centrality scores including both out-degree and in-degree. Figure 1 represents the global structure of international music flow graphically. The international music trade network is sparsely connected (i.e. out-degree density is 1.4% and in-degree density is 0.8%). The mean for out-degree centrality was $10.21 million (*SD* = $44.53m), while the mean for in-degree centrality was $10.21 million (*SD* = $33.42m).

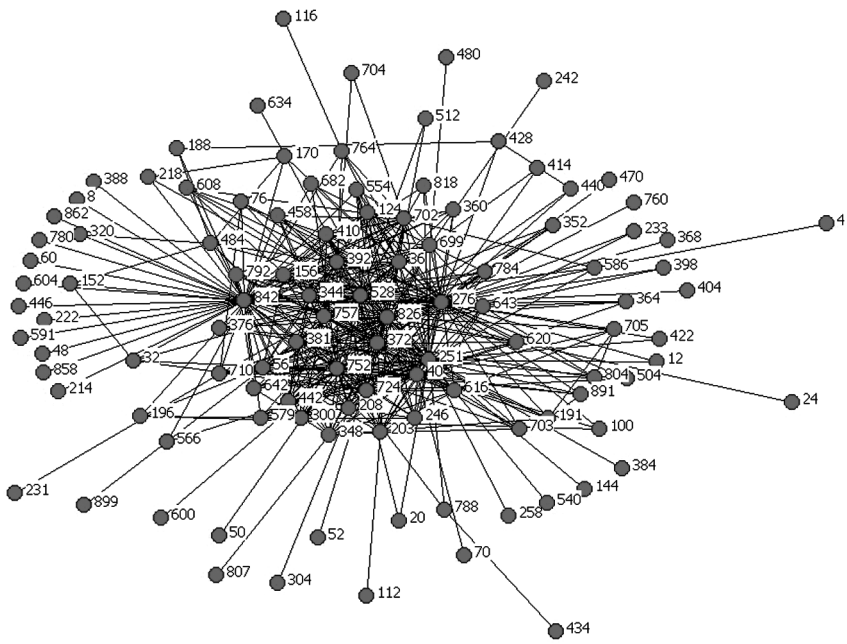

Figure 1. International music flow network in 2004
Note: Lines indicate a trading relationship between countries of a minimum of US$200 million.

Table 1. Degree centrality in the international music trade flows network

Code	Country	Out-degree	In-degree
276	Germany	4054.34	2198.64
842	USA	3321.91	1727.96
528	Netherlands	2019.37	1130.40
826	UK	2003.28	2423.10
372	Ireland	1954.64	351.89
702	Singapore	1725.44	230.32
040	Austria	1303.46	587.60
251	France	965.78	1738.04
752	Sweden	602.52	511.78
392	Japan	473.81	1821.12
124	Canada	450.91	1343.03
344	Hong Kong	445.09	432.72
056	Belgium	392.90	620.18
484	Mexico	301.55	273.10
757	Switzerland	289.70	540.33
699	India	246.60	601.73
724	Spain	240.84	592.74
410	Rep. of Korea	228.91	332.26
156	China	210.36	535.61
208	Denmark	179.09	297.36
616	Poland	171.10	110.36
442	Luxembourg	156.81	66.99
381	Italy	148.41	932.50
036	Australia	113.70	348.73
203	Czech Rep.	112.24	116.43
376	Israel	75.63	89.21
643	Russian Federation	65.21	113.30
348	Hungary	55.43	103.55
300	Greece	54.79	121.98
246	Finland	50.58	221.96
579	Norway	47.15	286.40
458	Malaysia	32.54	81.94
764	Thailand	28.80	48.94
620	Portugal	27.85	164.02
170	Colombia	27.76	32.27
032	Argentina	24.30	29.87
792	Turkey	21.96	58.08
705	Slovenia	16.98	38.58
076	Brazil	14.93	82.10
554	New Zealand	14.38	107.54
364	Iran	14.29	23.85
710	South Africa	11.73	122.87
112	Belarus	10.59	2.83
152	Chile	10.51	22.87
196	Cyprus	9.78	23.92
428	Latvia	9.41	14.97

(Continued)

Table 1. (Continued)

Code	Country	Out-degree	In-degree
191	Croatia	8.35	34.59
642	Romania	7.99	46.37
586	Pakistan	7.40	39.84
504	Morocco	7.31	34.81
703	Slovakia	6.98	59.71
100	Bulgaria	4.94	15.32
440	Lithuania	4.69	15.44
788	Tunisia	4.25	22.85
233	Estonia	3.72	13.59
188	Costa Rica	3.72	14.95
422	Lebanon	3.46	11.66
320	Guatemala	2.77	8.49
446	China, Macao SAR	2.65	2.85
604	Peru	2.47	9.88
470	Malta	1.89	7.63
858	Uruguay	1.64	5.39
218	Ecuador	1.24	16.30
144	Sri Lanka	1.13	8.30
398	Kazakhstan	1.12	10.70
834	Tanzania	0.93	2.24
031	Azerbaijan	0.87	2.65
807	TFYR of Macedonia	0.59	17.25
400	Jordan	0.45	4.70
480	Mauritius	0.44	5.54
020	Andorra	0.42	17.46
222	El Salvador	0.28	6.33
894	Zambia	0.22	1.79
512	Oman	0.22	11.17
352	Iceland	0.17	14.48
068	Bolivia	0.16	1.93
591	Panama	0.13	8.50
070	Bosnia Herzegovina	0.10	12.49
496	Mongolia	0.10	0.36
404	Kenya	0.10	8.30
258	French Polynesia	0.06	7.98
498	Rep. of Moldova	0.05	3.29
048	Bahrain	0.05	4.72
540	New Caledonia	0.04	8.96
242	Fiji	0.04	5.01
716	Zimbabwe	0.03	1.41
340	Honduras	0.03	3.25
558	Nicaragua	0.02	1.88
800	Uganda	0.02	0.78
600	Paraguay	0.01	5.67
266	Gabon	0.01	0.61
454	Malawi	0.01	1.83

Table 1. (Continued)

Code	Country	Out-degree	In-degree
780	Trinidad & Tobago	0.01	2.47
050	Bangladesh	0.01	25.13
012	Algeria	0.01	20.13
854	Burkina Faso	0.00	1.11
214	Dominica	0.00	0.10
500	Montserrat	0.00	0.01
882	Samoa	0.00	0.09
417	Kyrgyzstan	0.00	0.24
450	Madagascar	0.00	1.88
116	Cambodia	0.00	7.86
051	Armenia	0.00	2.04
008	Albania	0.00	4.82
686	Senegal	0.00	1.58
184	Cook Islands	0.00	0.21
388	Jamaica	0.00	2.85
234	Faeroe Islands	0.00	1.16
462	Maldives	0.00	0.34
192	Cuba	0.00	2.36
508	Mozambique	0.00	0.93
562	Niger	0.00	1.43
516	Namibia	0.00	0.79
682	Saudi Arabia	0.00	32.86
660	Anguilla	0.00	0.02
704	Vietnam	0.00	20.43
175	Mayotte	0.00	0.34
384	Cote d'Ivoire	0.00	5.35
768	Togo	0.00	0.41
784	United Arab Emirates	0.00	119.98
204	Benin	0.00	0.29
740	Suriname	0.00	0.29
466	Mali	0.00	1.14
887	Yemen	0.00	3.81

Notes: $N = 124$. Degree: $US millions.

In terms of out-degree centrality, the western industrialized nations including Germany ($4054.34m), the USA ($3321.91m), the Netherlands ($2019.37m) and the UK ($2003.28m) were most central. These countries hold a central position in the global music network. The semi-peripheral countries include some European, Asian and Latin American countries. For example, Belgium, Greece, South Korea, China, Mexico and Brazil hold a semi-peripheral place in the network. The peripheral countries are composed of the developing countries. Mali, Senegal, Togo and the Faeroe Islands are at the periphery.

In terms of in-degree centrality, the UK ($2423.10m), Germany ($2198.64m) and Japan ($1821.12m) were the most central, followed by the France ($1738.04m), the USA

($1727.96m), Canada ($1343.03m), the Netherlands ($1130.40m) and Italy ($932.50m). Similar to out-degree results, the semi-peripheral countries were some European, Asian and Latin American countries, while most African countries were at the periphery.

RQ2: description of structural changes in international music flow over time

To examine the structural changes in the international music trade network from 2002 through 2006, a total of 32 countries including 27 OECD countries plus China, Israel, the Russian Federation, India and Singapore were selected. The selection was due to two reasons. One is that more than half of 141 countries had missing music trade data between 2002 and 2006. Another reason is that the overall trade of the 32 countries selected accounts for more than 95 percent of international music trade in 2004.

Changes in the network over time Overall, the network remained relatively stable over the period of investigation. The total degree centrality tended to increase over time, but since 2006 it has decreased, perhaps as a result of digital music sales over the internet. According to an IFPI recent report, worldwide online music sales almost doubled in 2006 to about US$2 billion (IFPI, 2007).

Changes at the core The 10 most central countries remained relatively stable but steadily centralized over time. For example, Germany, the USA and the UK steadily maintained the highest ranks in total degree centrality. Interestingly, Germany was the most central nation following a merger between Bertelsmann and Sony in 2004. The most central nation in 2006 was Germany, followed by the USA, the UK and the Netherlands. The nations of the big four music companies were identical to the central nations in international music trade in 2006.

Changes at the semi-periphery There was little change over time among the semi-peripheral countries. The semi-peripheral nations comprise nine countries: Sweden, Italy, China, Switzerland, Belgium, Spain, India, South Korea and Mexico. However, there was some movement in out-degree and in-degree centrality, even though the total degree centrality remained unchanged.

Changes at the periphery There was little change in the peripheral countries from 2002 through 2006. These include Luxembourg, Hungary, Denmark, Australia, Norway, Finland, Portugal, the Czech Republic, Greece, Israel and the Russian Federation. Hungary, Greece and the Russian Federation have consistently been the least central.

Quadratic assessment procedure analysis QAP was used to evaluate the strength of the relationship between each pair of networks. The network structures of each of the five study years were compared to one another using QAP. The correlations between the networks from 2002 to 2006 are presented in Table 2 (e.g. overall correlation is .97).

Table 2. QAP correlations between the networks from 2002 to 2006

	1	2	3	4	5
1. 2002	–	–	–	–	–
2. 2003	.980**	–	–	–	–
3. 2004	.959**	.982**	–	–	–
4. 2005	.936**	.958**	.981**	–	–
5. 2006	.957**	.973**	.980**	.976**	–

**$p < .01$.

Cluster analysis The hierarchical cluster analysis indicates that the music network is composed of three regional groups. The largest cluster comprises the North American and Asian countries (group 1). Within this group, there are two subgroups that can be categorized as (a) the North American countries plus South Korea and Mexico and (b) the Asian nations plus Australia. The former subgroup is composed of the USA, Canada, Mexico and South Korea and the USA–Canada dyad is the most central, whereas the latter subgroup included Singapore, Japan, Hong Kong, China and Australia and the Singapore–Japan dyad is most central.

The second cluster (group 2) is composed of 10 European countries: the UK, Ireland, Germany, Austria, France, the Netherlands, Italy, Switzerland, Belgium and Spain. The UK and Ireland dyad is the most central. The third cluster (group 3) comprises the Scandinavian and Eastern European countries plus India and Israel. Within this cluster, there are two subgroups that can be labelled as (a) the Scandinavian group and (b) the Eastern European group. The Scandinavian group is composed of Sweden, Denmark, Norway and Finland. It also includes Poland and Luxembourg as peripherals. The Eastern European group is composed of the Russian Federation, the Czech Republic, Greece and Hungary.

RQ3: determinants of the international music trade

The 2004 data for 114 countries were used to examine what factors determine the global structure of the international music flow network. Ten countries were excluded because of their missing values for GDP, population, language or internet use. Table 3 presents the means and standard deviations of measures of international music flow and the factors influencing it in this study. Also, Tables 4a–4c shows the results of correlations between the variables. Regarding multicollinearity, there were no strong relationships between the variables.

Regression analysis

Table 5a illustrates the results of the regression analysis. The total degree centrality in the international music trade was the dependent variable. In the 2004 international music flow network, GDP, internet use, population and language explained 59.3 percent of the total variance in total degree centrality, $F(4, 109) = 39.72$, $p < .001$, adj. $R^2 = .578$. GDP was the strongest predictor ($\beta = .59$, $p < .001$), followed by internet use ($\beta = .27$, $p < .001$)

Table 3. Means and standard deviations

	Mean	*SD*
1. Total degree	396.80	1001.20
2. Out-degree	200.17	610.53
3. In-degree	196.64	450.48
4. GDP	349,017.37	1,239,285.25
5. Population	45.16	159.81
6. Language	0.48	0.50
7. Internet use	226.08	225.09

Notes: $N = 114$. Degree: $US millions; GDP: $US millions; population: millions; internet use: number of users per 1000 population.

Table 4a. Correlations between variables in international music flows (total degree model)

	1	2	3	4	5
1. Total degree	–				
2. GDP	.703**	–			
3. Population	.174	.296**	–		
4. Language	.235**	.106	–.011	–	
5. Internet use	.470**	.321**	–.085	.111	–

Notes: $N = 114$. *$p < .05$, **$p < .01$.

Table 4b. Correlations between variables in international music flows (out-degree model)

	1	2	3	4	5
1. Total degree	–				
2. GDP	.647**	–			
3. Population	.117	.296**	–		
4. Language	.249**	.106	–.011	–	
5. Internet use	.405**	.321**	–.085	.111	–

Notes: $N = 114$. *$p < .05$, **$p < .01$.

Table 4c. Correlations between variables in international music flows (in-degree model)

	1	2	3	4	5
1. Total degree	–				
2. GDP	.686**	–			
3. Population	.227	.296**	–		
4. Language	.186*	.106	–.011	–	
5. Internet use	.495**	.321**	–.085	.111	–

Notes: $N = 114$. *$p < .05$, **$p < .01$.

and language (β = .16, $p < .05$). However, population (β = .02, $p = .79$) was not statistically significant in predicting international music flow.

Table 5b demonstrates the results of multiple regression analysis when the out-degree centrality in the international music trade was used as a dependent variable. The multiple regression analysis revealed that GDP, internet use and language were significantly associated with the out-degree centrality: GDP (β = .57, $p < .001$), internet use (β = .21, $p < .01$), language (β = .18, $p < .05$). GDP, internet use, population and language explained 50.0 percent of the total variance in out-degree centrality, $F(4, 109) = 27.28$, $p < .001$, adj. $R^2 = .482$.

The results of the regression analysis for in-degree centrality as the dependent variable are presented in Table 5c. GDP, internet use, population and language explained 58.3 percent of the total variance in in-degree centrality, $F(4, 109) = 38.05$, $p < .001$, adj. $R^2 = .567$. GDP was the strongest predictor (β = .54, $p < .001$), followed by internet use (β = .33, $p < .001$). However, language (β = .11, $p = .09$) and population (β = .09, $p = .17$) were not statistically significant.

Table 5a. Multiple regressions predicting international music flow (total degree model)

Model	b	SE	β	*t*	*p*
Constant	−202.571	103.858	−1.950	.054	
GDP	.000	.000	.593	8.622	.000
Population	.111	.409	.018	.271	.787
Language	314.064	123.314	.157	2.547	.012
Internet use	1.219	.294	.274	4.143	.000

Notes: $R^2 = .593$, $F(4, 109) = 39.719$, $p < .01$.

Table 5b. Multiple regressions predicting international music flow (out-degree model)

Model	b	SE	β	*t*	*p*
Constant	−123.650	70.186		−1.762	.081
GDP	.000	.000	.573	7.513	.000
Population	−.144	.276	−.038	−.521	.604
Language	219.270	83.335	−.180	2.631	.010
Internet use	.557	.199	.206	2.803	.006

Notes: $R^2 = .500$, $F(4, 109) = 27.277$, $p < .01$.

Table 5c. Multiple regressions predicting international music flow (in-degree model)

Model	b	SE	β	*t*	*p*
Constant	−78.921	47.324		−1.668	.098
GDP	.000	.000	.542	7.779	.000
Population	.255	.186	.090	1.367	.174
Language	94.793	56.189	.106	1.687	.094
Internet use	.662	.134	.331	4.934	.000

Notes: $R^2 = .583$, $F(4, 109) = 38.047$, $p < .01$.

Discussion and conclusion

The findings of this study reveal the disparity in international music trade between the core and the periphery. Consistent with research in this area, the developed countries hold a leading position as both the dominant exporters and importers in the music trade network, whereas the developing countries are net importers of music goods. More specifically, whereas the USA, the European and a few of the Asian countries (e.g. Japan and Singapore) are at the core, most African, Asian and Latin American countries are at the periphery. This implies that peripheral countries are not only dominated by the asymmetrical music trade with the core, but also structurally marginalized by the music trade among the core countries. Thus, the structural inequality between the developed and the developing countries leads to international media dependency in the international music flow network.

The current research presents trends and structural patterns of changes in international music trade network from 2002 through 2006. Overall, the network remained relatively stable. Cluster analysis shows that network may be categorized into three geographical groups; (1) North America and Asia, (2) Western Europe, (3) Scandinavia and Eastern Europe. The results support Huntington's (1996) view that the world is currently divided into regional subsystems with extensive communication between culturally homogeneous nations. In harmony with the literature on international media flows (McQuail and Windahl, 1993; Sepstrup, 1989), countries that share the same language and are physically proximate have a tendency to exchange music products more than countries that do not speak the same language or are physically distant. In terms of bilateral trade in music products, this study shows that the USA–Canada dyad is the most central, followed by Singapore–Japan, the UK–Ireland and Germany–Austria.

Another significant finding is that the nations of the top four music companies correspond to the most central nations in international music trade in 2006 (e.g. Germany – Sony, the USA – Warner, the UK – EMI and the Netherlands – Universal). This result implies that the core nations have expanded and controlled the international market as a consequence of media globalization. In other words, it suggests that the benefit of more efficient distribution technologies in the music industry have not enriched all nations equally. Rather, a small number of very large media companies are maintaining and enhancing their positions of economic power through a sequence of merger and acquisition and vertical integrations, consistent with research in this area (Bishop, 2005; Leyshon et al., 2005). The finding indicates that the process of media globalization promotes relations of media dependency among nations rather than impartial economic growth. However, although this argument may be implicitly supported by the correspondence between the big four labels and the most central nations, the evidence is still insufficient to conclude that the dominance of a few of the developed countries may be simply due to their big music companies. This study has examined what factors determine the global structure of international music flow by employing multiple regression analysis. The results indicate that a country's economic development, the language(s) its people speak and technological development are the most influential factors determining the global structure of international music flows. In particular, economic development is the strongest determinant of the global structure of international music flows in three separate regression analyses, consistent with world system theory. However, the results show

that non-economic factors are also significant predictors of international music flow and its direction, consistent with Galtung's (1971) structural theory of imperialism.

In the present study, unlike past research that suggested that population plays a key role in international media trade flows, this variable is not statistically significant. This result may be due to the case of China and India. First, these two countries with larger populations are semi-peripheral. Moreover, both have relatively high music piracy rates. According to an IFPI music piracy report, the markets for pirated music in the two countries are larger than the commercial markets (i.e. 85% in China and 56% in India) (IFPI, 2005). Another report (Screen Digest, 2002) shows that both China and India have relatively lower shares of the global record market, compared with their shares of the world music population (e.g. China has 30.3% of the total world music population and 0.5% of the total music market, and India 18.8% and 0.6% respectively). In this sense, future studies should consider more relevant indicators of population in selecting influential factors that determine international music flows.

A contribution of this study is to provide a global picture of the nature and direction of international music trade. Compared to other cultural products, music has received relatively little attention in the study of international media flows, even though it is regarded as a vehicle of transmission of cultural values and ideas. Considering the lack of existing studies on international music trade flows, this study provides an alternative way of looking at international music trade by using network analysis.

Another contribution is to identify the relationships between technological development and the global structure of international music flows. Past studies in this area did not include technological factors (e.g. communication networks) as potential determinants influencing international music trade flows. This study employed internet use as a communication technology and showed that technological development plays a key role in international music flows. The finding suggests an implication of the relationship between the telecommunications network and asymmetric music trade in the international music network. In this sense, future studies should examine whether digitally networked technologies have changed other international media flows (e.g. films, newspapers and TV programs).

This research has some limitations. First, even though this study explored the current structure of international music flows, the data were limited to the exports and imports of only tangible recorded music goods. Therefore, interpretation of the present results should be done carefully within the limits of the available data. The patterns of international music trade may change due to the absence of other significant information on international music flow (e.g. musical instruments, online downloading, copyrights, royalties). To date, there are no specific data for intangible musical trades because it is difficult to estimate these transactions internationally or domestically (UNCTAD, 2008; UNESCO, 2005). Future studies could provide comprehensive information of the direction and magnitude of international music flows by seeking to obtain more complete measures. However, it is important to note that a recent statistical report by IFPI (2009) shows that the USA holds a dominant position in digital sales and accounts for approximately 50 percent of international sales in 2008, whereas Japan is the global leader in the mobile music market. These findings imply that the center–periphery structure of the international music flow network also exists within the digital market.

Second, the current study may oversimplify international relations by applying the traditional core–periphery model largely based on an economic perspective, failing to recognize the complexity of international media trade in the global system (Rihani, 2002). Thus, future research should consider other important factors such as geographical distance, colonial history, political system, intellectual property protection, media regulation and the rise of the online music market. For example, when Ki et al. (2006) examined what factors influence music piracy rates across nations, the authors found that a country's music piracy rate is significantly associated with the level of intellectual property protection. Highlighting the fact that a country's music trade is related to its piracy rate, future study may examine the level of intellectual property and music piracy rates as a mediator or moderator in predicting international music trade flows.

In conclusion, this study used nation-states as the unit of analysis to provide a description of the global structure of international music trade flows. The current study not only examined the structure and patterns of international music trade flow, but also explored its determinants by using a variety of methods. The results indicate that there is an imbalance in the structure of international music flows, which may be interpreted as media dependency.

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